The OIL AND GAS JOURNAL

published weekly by the

PETROLEUM PUBLISHING COMPANY

211 S. CHEYENNE ST., TULSA, OKLAHOMA

Subscription price, United States and foreign, 1 year, $8.00; 2 years, $10.00; 3 years, $12.00; 5 years, $15.00. Single copies, 20 cents. Back copies, when over a year old, 50 cents. Entered as second-class mail matter at Tulsa, Okla., under Act of March 3, 1879. Copyright 1944, by The Petroleum Publishing Co.

Vol. 42, No. 42 February 24, 1944

P. C. LAUINGER, *President* — C. O. WILLSON, *Editor*

S. H. ROURKE, *Business Manager* — H. STANLEY NORMAN, *Managing Editor*

R. C. MAC DOUGALL, *Circulation Manager* — ARCH L. FOSTER, *Refinery Editor*

W. L. NELSON, *Technical Editor* — PAUL REED, *Pipe-Line Editor*

HARRY F. SIMONS, *Production Engineering Editor*

Associate Editors

LYNN M. NICHOLS — NEIL WILLIAMS

CHARLES J. DEEGAN

District Editors

JAMES McINTYRE, Tulsa 1, 211 S. Cheyenne Ave. — CARL HOOT, Tulsa 1, 211 S. Cheyenne Ave.

THOMAS F. SMILEY, Tulsa 1, 211 S. Cheyenne Ave. — E. H. SHORT, JR., Houston 2, Sterling Bldg.

L. P. STOCKMAN, Los Angeles 14, Union Oil Bldg. — HARRY F. SIMONS, Fort Worth 2, Petroleum Bldg.

HENRY D. RALPH, Washington 4, Natl. Press Bldg. — TOLBERT R. INGRAM, Denver 2, State Office Bldg.

O. C. PRESSPRICH, Saginaw, News Bldg. — J. P. O'DONNELL, New York 17, 415 Lexington Ave.

VICTOR LAURISTON, Chatham, Ont., 36 Stanley Ave. — A. C. MacINTYRE, Oil City, Derrick Bldg.

Advertising

E. KLAPPENBACH, *Vice President*

KENNETH J. LANGLEY, *Eastern Manager*, New York 17, 415 Lexington Ave. — HOWARD MARKT, *Cleveland Manager*, Cleveland 14, Leader Bldg.

C. R. FARMER, *Chicago Manager*, Chicago 2, 105 W. Madison — J. HOWARD TINKHAM, *California Manager*, Los Angeles 15, 1400 S. Grand Ave.

WAYNE RIVES, *Gulf Coast Manager*, Houston 2, Sterling Bldg. — A. J. CHAMBERS, Twickenham (Middlesex) England, 72 Cole Park Road

MITCHELL TUCKER, *Manager, Research Dept.*, Tulsa 1, 211 S. Cheyenne Ave. — JOHN D. REILLY, *Production Manager*, Tulsa 1, 211 S. Cheyenne Ave

Member
Audit Bureau of Circulations
Associated Business Papers

Table of Contents

NEWS DEVELOPMENTS

Senate Starts Work on Foreign Oil Policy 56
Mexico's Production Opens With Rise 56
Middle East Pipe Line Proposal May Upset Entire Industry 58
Deegan Joins Journal Editorial Staff 59
Productive Capacity Continues Slump 60
Incentive Plan for Oil Expected Soon 60
Decline of 18.6 Million Barrels in Reserves Shown by A.P.I. 61
President of I.P.A.A. Denounces Arabian Pipe-Line Project 62
Petroleum Butadiene Competitive With Natural Rubber 62
Postwar Economic Problems Discussed Before A.I.M.E. 64
Conversion of Big-Inch Line to Gas Approved by Swensrud 65
Deaths in the Industry 70

Trends 55
This Week 57
Editorial 63
Refining News 117
Pipe-Line News 124
Natural-Gas News 124

ENGINEERING-OPERATING

Shell-Developed Cumene Speeds Aircraft-Fuel Program 73
Pressure Maintenance by Conjoint Injection of Gas and Water 78
Oil-Well Pumping Practices—No. 28 92
A.I.M.E. Digests 97
Cradles for Large Cylinders 111
Heavy Angle-Bending Attachment 111

Pipe-Line Suggestions ... 90
Questions on Technology .. 106
Books 109
Plant Practices 110
Cost Engineering 113
Eng. Fundamentals 115

EXPLORATION AND DRILLING

Week's Highlights 127
Completions in All Fields 127
Daily Average Production for Week 128
Reports by Areas Start on Page 128
Summary of Operations for January 142
Weekly Wildcat Completions and Discoveries 143

ADDITIONAL FEATURES

Drilling Contractors 144
Personals 146
Market Developments 149
Refinery Price Summary .. 149
Equipment Progress 151
Classified Advertising 154
Calendar of Events 158
Advertisers' Index 158

General Heading: BAKER ROTARY WALL SCRAPER

Unit No. A-28

Subject: Scraping Cement Off Producing Zone

BAKER OIL TOOLS, INC.

Main Office and Factory:
6000 So. Boyle Ave., Box 127, Vernon Station, Los Angeles, Calif.
Central Division Office and Factory:
6023 Navigation Blvd., Box 3048, Houston, Texas
Export Sales Office:
19 Rector Street, New York, N. Y.

Of the many practical field applications for the Baker Wall Scraper, cleaning up oil sands is one of the most important. In such applications, the amount of actual hole enlargement varies according to the character and thickness of the substance to be removed.

Where only the mud cake is to be scraped off the oil sand, usually a cut of approximately an inch or less is sufficient. In other cases, where both cement and formation is to be removed, it may be necessary to enlarge the hole a number of inches such as in the job illustrated below.

REPORT ON BAKER WALL SCRAPER

Date 1942

Company X X X X

Field Midway, Arkansas Well and Lease X X X

Person in Charge X X X Position X X X

Depth of Well 6453' Circulating Fluid (mud or oil) Mud

Size of Casing Run Through 5½" Depth 6410'

Size of Scraper Used 2" Size of Blades 9"

Were Blades Factory Built? Yes Outside Rebuilt?

No. of Blades Used 1 pair Condition After Use Good

Nature of Formation Producing Zone

Size of Hole Before Scraping 4¾" After 9"

Distance Scraped 41' From 6412' To 6453

Condition of Scraper After Use Good

Time Consumed on Each Run 9 Hours

Was Scraper Satisfactory in Performance? Yes

NATURE OF JOB: (Check Below)

Producing:
1. Cleaning Oil Sands ✓
2. Setting Liners

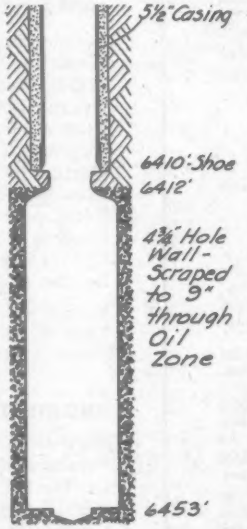
Cementing:
1. Bottlenecking
2. Setting Cement Plug

Drilling:
1. Sidetracking
2. Straightening Hole
3. Whipstocking

Running Casing:
1. Cleaning Hole to Gauge

Other Operations:

Sketch of the Job



Detail of Job and Practical Results Scraping Cement off Producing Zone

Reported By Courtney J. Berlin

Product No. 500
Baker Rotary Wall Scraper

These are the Features Which Make the BAKER ROTARY WALL SCRAPER A DEPENDABLE TOOL

(1) Double Pin Drill Collar — Connects Wall Scraper Body to drill collar.

(2) Circulation Screen — Design of cone-shaped Screen minimizes abrasive action of fluid and prevents debris from clogging circulation passages.

(3) Wall Scraper Body — Machined out of a solid piece of special alloy steel . . . provides great strength.

(4) Plunger Head — Provided with oil resistant Seals to prevent fluid by-pass and insure Piston efficiency . . . Blades will Positively Open.

(5) Plunger Spring—Strong Plunger Spring insures proper closing of blades.

(6) Bushing (Circulation Bean) — Fluid is directed on each blade, lubricating and cooling cutting surfaces.

(7) Hinge Pin — Machined from solid piece of special alloy steel.

(8) Blades — Machined from special alloy steel forgings . . . afford toughness and hardness. Cutting edges are hard-faced and set with Tungsten Carbide Inserts. Long bearing surface on blades minimizes "corkscrewing."

(9) Blade Expansion — Amazing reaming capacity provided by expansion range of Cutter Blades from 4" to 36".

the OIL AND GAS JOURNAL

Trends

Crude-Oil Production
By States—Page 128

CRUDE-OIL STOCKS 238,206,000 bbl. as of Feb. 12—down 939,000. One year ago 234,239,000 bbl.

GASOLINE STOCKS 82,322,000 bbl. as of Feb. 12—up 538,000 bbl. One year ago 91,758,000 bbl.

RESIDUAL FUEL-OIL STOCKS 52,453,000 bbl. as of Feb. 12—down 281,000. One year ago 70,815,000.

GAS OIL AND DISTILLATE 34,854,000 as of Feb. 12—down 1,299,000. One year ago 36,888,000.

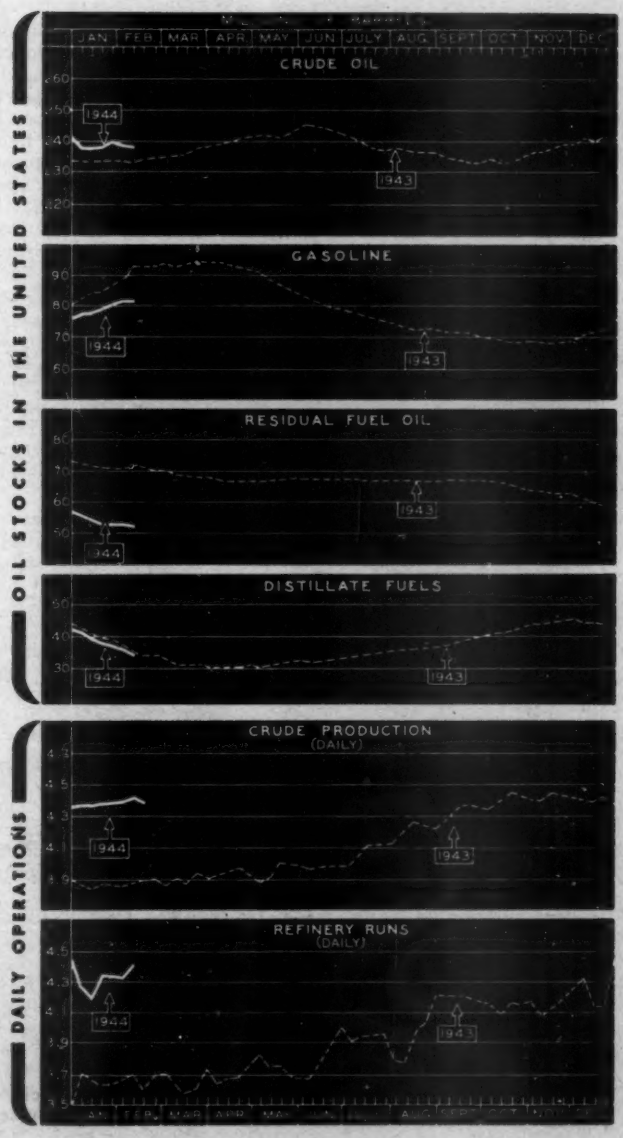
CRUDE-OIL PRODUCTION 4,387,435 bbl. daily average—down 25,525 bbl. One year ago 3,894,125.

REFINERY RUNS 4,428,000 bbl. daily week ended Feb. 12—up 104,000 bbl. One year ago 3,569,000.

DESPITE expanding requirements, the Petroleum Administration for War is recommending another small reduction in the production of petroleum liquids for March. Its recommended daily output for next month is 4,698,900 bbl. daily, which compares with 4,701,400 bbl. daily this month. In January the recommended production was 4,707,400 bbl. daily. Neither in January nor so far in February has the actual output of petroleum liquids been as large as the PAW recommendation. In this connection it is not realized by many that the PAW recommendation based on available domestic crude-oil output has shown little change over the past 6 months. The projected March output is only 60,200 bbl., or 1.3 per cent higher than in October last year.

THE situation as outlined for March is similar to that which has been controlling crude-oil production the past several months. So far as Districts 1, 2 and 5 are concerned the fields are now producing practically at capacity, and the records show that it has been necessary to reduce allowables in several fields, reflecting declines in productive capacity. Probable production of Districts 1 and 2 has been projected over the rest of the year, and, barring important new discoveries which could be quickly developed, the expected trend in available production is downward. What this means in refinery operations for the two districts is apparent from the schedule of crude runs to stills for the second and third quarters. This is particularly true of the smaller plants, which are entirely dependent on local crude-oil supplies for their operation.

WHAT can be done in the matter of remedies centers in District 3, with 56 per cent of the recommended output for March. As has been pointed out by those Washington commentators who are critical of the continuance of petroleum shortages in the East and Middle West, some crude oil has been run to storage in District 3 in recent weeks, and there also have been accumulations of certain refined products. State officials in Texas are authority for the statement that transportation conditions are responsible for any increases in inventories. The relief through increased tanker transportation has not been as great as was expected in the Gulf Coast areas, and the coordination of all transportation which was planned for early 1944, looking to substantial increases in Texas crude-oil production, has not materialized.



Senate Starts Work On Assignment to Develop Policy On Foreign Oil

by Henry D. Ralph

WASHINGTON, D. C. — Senate action is expected this week to create a special committee to recommend a national foreign-oil policy as proposed in Senate Resolution 253 introduced jointly by Senators Brewster of Maine and Moore of Oklahoma.

The Senate committee on commerce has favorably reported the resolution with an amendment to include representatives from the committee on public lands. In its revised form the committee would consist of two members each from the Senate committees on foreign relations, commerce, interstate commerce, and public lands, with a ninth appointed by Vice President Wallace.

Members of the oil-policy committee named so far:

Commerce committee: Brewster, Maine, and Maloney, Connecticut; interstate commerce committee: Johnson, Colorado, and Moore, Oklahoma; public lands committee: O'Mahoney, Wyoming.

Scope of Assignment

The resolution directs this committee to make "a full and complete study and investigation with respect to petroleum resources, and the production and consumption of petroleum and petroleum products, both within and outside the United States, in their relation to our national welfare and security."

The committee is to report to the Senate at the earliest practicable date, together with recommendations for the formulation of a national-petroleum policy.

This committee probably will persue the suggestions for a foreign-oil policy outlined by the Truman committee in its report last week, and one of the first matters of investigation is expected to be the Petroleum Reserves Corp. and its proposal to finance a pipe line across Saudi Arabia, from the Persian Gulf to Haifa on the Mediterranean (see February 7 and 14 Journals).

Before the new investigation gets under way it is possible that the State Department will issue a memorandum giving the background and objectives of forthcoming discussions with a British mission on broad subjects of postwar petroleum policies. Such a statement was promised for last week but its issuance was postponed.

A second congressional committee to investigate petroleum was proposed last week by Rep. Jerry Voorhis of California in House Resolution 442. The House committee would include 15 men, three each from the committees on public lands, naval affairs, interstate and foreign commerce, agriculture, military affairs, and mines and mining.

Their investigations would cover:

The extent of petroleum reserves in the United States and its possessions.

The extent of holdings of various oil companies of such reserves, and the degree to which they are owned by integrated oil companies.

The extent to which monopolistic practices exist in the petroleum industry.

An analysis of policies pursued by major oil companies regarding control over production, handling of reserves, management of pipe lines under their ownership and distribution and marketing of petroleum products.

The relationship of various groups in the oil industry to federal and local government.

The extent of oil reserves underlying the public domain.

Potential sources of petroleum outside the United States and its possessions, and recommendations on governmental policy regarding them.

Voorhis, who has criticized the Petroleum Administration for War for bringing too many major oil company men into its staff, told the House he was more concerned with oil companies "invading the government" than with the expressed fears of other House members that the government was going into competition with the oil industry.

Mexico's Production Opens Year With Rise

MEXICO's crude-oil production recovered some of the year-end decline in January operations during which recovery by properties managed by Petroleos Mexicanos, the government oil agency, averaged 107,540 bbl. daily. In December 1943, daily average production was 104,062 bbl. The production data do not include small output, ranging between 3,000 to 4,000 bbl. daily, from properties of independent companies not under management of Petroleos Mexicanos.

A year ago, Pemex production averaged 74,609 bbl. daily, showing that the current output has risen about 33,000 bbl. The highest recent level of Mexican crude-oil production was reached in October 1943 when output averaged 110,300 bbl. daily.

Bulk of Mexican production is drawn from the Poza Rica field where the output of 57,990 bbl. daily in January 1944 increased about 2,500 bbl. over the December 1943 yield of 55,485 bbl. and compares with daily production of 55,775 bbl. daily from that area during the first month last year.

MEXICAN PRODUCTION BY FIELDS

Field—	Jan. 1944	Dec. 1943	Jan. 1943
North Tampico	420,172	409,127	52,220
South Tampico	709,587	694,296	131,209
Poza Rica	1,797,676	1,720,032	1,729,027
Isthmus area	406,265	402,466	400,440
Total Pemex	3,333,700	3,225,921	2,312,896
Daily average	107,540	104,062	74,610

New Agreement Near on Mexican Oil Program

WASHINGTON, D. C. — Efrain Buenrostro, head of the Mexican Government's Petroleos Mexicanos, is in Washington to arrange for materials, technical assistance, and financing for an extensive program for rehabilitation of Mexican oil fields and construction of new refining and pipeline facilities.

Negotiations on this matter have been made sporadically for more than a year, but it is understood that an agreement now has been reached in principle with the U. S. Government agencies concerned, the Department of State, Foreign Economic Administration, and Petroleum Administration for War. Definite announcement of the program is expected shortly.

THIS WEEK

DRILLING—Well completions at the end of the seventh full week stand 22 per cent above same period a year ago. . . . ¶Many locations in newer fields, West Edmond in Oklahoma for example, await drilling contractors and tools. . . . ¶Wavering start in January appears overcome, supplanted by steady increase which must be sustained, extended, to meet goal of 24,000 wells for the year. . . . ¶More rigs being returned to service as materials become more available, flow of new equipment expected to rise in second and third quarters. . . .

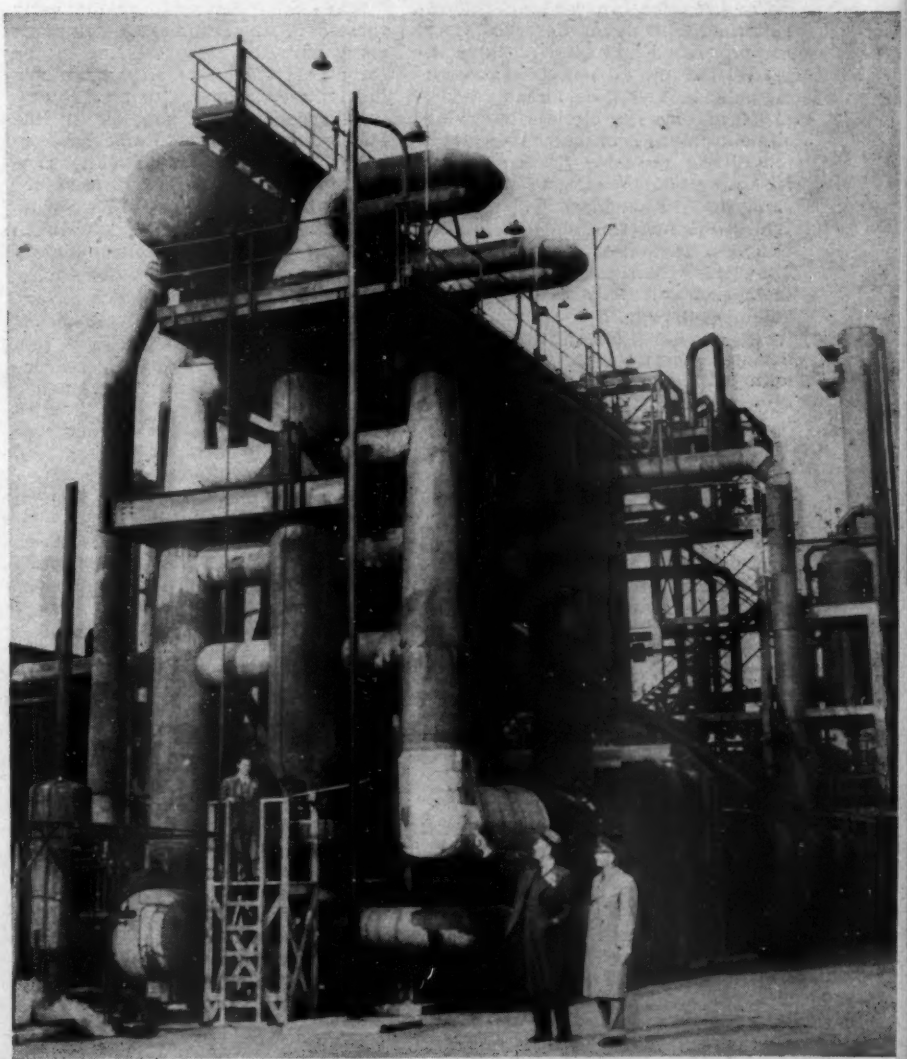
SUPPLIES—Index of East Coast supplies discontinued, without explanation. . . . Figures on distillate fuel oil didn't mesh with warnings of shortages from Washington. . . . ¶Crude stacking up at Texas refineries, shipping terminals, field storage. . . . ¶Completed part of Stanolind Pipe Line Co.'s 16-in. line from Slaughter field pressed into service for storage. . . . More sections to be completed as rapidly as possible for use in storing current production. . . . ¶Tank-car shortage chief factor in disruption of normal flow of supplies; also tankers have been withdrawn from coastwise runs. . . .

PRICES—OPA nearly ready to submit production incentive plans to Office of War Mobilization. . . . Details of proposals are still fuzzy, believed to offer no solution to the previous objections to subsidies. . . . ¶House subcommittee created to investigate entire question of petroleum prices, will consider specific proposal from OPA, hear industry sponsors of general advance. . . .

RUBBER—Petroleum process for manufacturing butadiene shown by government report capable of competing economically with natural rubber. . . . ¶Alcohol process too expensive for permanent operation, unless raw-material price is halved. . . . ¶New additions and changes in previously authorized plants lift total outlay for synthetic rubber to $730,124,554. . . . Petroleum industry's share covers 399,360 short tons of butadiene, $214,490,515 of the cost. . . . Synthetic rubber from peacetime operation of petroleum-butadiene process will cost from 12 to 25 cents a pound.

PRODUCTION—Net reduction of 2,500 bbl. in PAW daily production quotas for March reflects waning productive capacities in Middle West, East and Pacific Coast states. . . . ¶Texas purchasers suggest lower allowables for some areas, until transportation jams clear up, but March proration schedule matches unchanged PAW quota. . . . ¶Potential discovery in western Alabama stimulates interest in southeastern states. . . . ¶Florida discovery lifting over 600 bbl. of fluid daily, oil recovery of 70 bbl. daily about unchanged. . . .

TRANSPORTATION—Economic study shows conversion of one or both big-inch lines to natural-gas service is practical. . . . No change probable, however, until middle of summer or later. . . . ¶Magnolia Pipe Line Co.'s new West Texas line will start operation March 1, easing transportation situation there to extent of 42,000 bbl. daily. . . . ¶WEP 24-in. moved 88,000,000 bbl. in first year of operation and Bayou system handled more than 20,000,000 bbl. of products in 12 months. . . .



Acme Photo

Here is one of the versatile convertible petroleum war plants. Process design permits operation of the unit either for maximum production of toluene or for yield of 100-octane gasoline components. Recent experience at this Richmond, Calif., plant proves that the necessary conversion adjustments can be made overnight. R. G. Follis, manager of manufacturing for Standard Oil Co. of California, and Col. K. B. Harmon are in the foreground

Middle East Pipe Line Proposal May Upset Entire U.S. Petroleum Industry

by Charles J. Deegan

This analysis of the government pipe-line project in the Middle East and other recent developments dealing with this country's future foreign-oil policy is based on the author's observations during 2 years in Washington. He outlines and appraises the forces which are shaping destiny of the petroleum industry for the next quarter century.

THE petroleum industry seems destined to play the leading role in a dramatic period during which the United States is going to determine its world policies for the next quarter century. The discovery that ample petroleum reserves are essential to victory in modern war coincides with a decision by the American people that while another war may be the result of active participation in international affairs, future wars are inevitable unless this nation does take an active and continuing part in international affairs in this shrinking world.

The proposed congressional investigation of Petroleum Reserves Corp. has broadened into a far-reaching investigation into all aspects of foreign-oil policies, and it is already recognized in business circles that while oil policy alone is of major importance it will also probably fix the pattern for United States' international policy along many other lines.

Most oil men welcome the interest Congress is taking in the question. They want policies that will affect their economic existence hammered out in Congress, in the open, where they can have their day in court. National security is intimately joined with petroleum reserves.

Industry's Demonstrated Ability

Oil men have demonstrated their ability in war as well as in peace. They feel that their judgment and counsel should be considered openly by the people when such vital, long-term policies are under consideration.

The recent public statements about PRC by Secretary Ickes have raised more questions than they have answered. The pipe line is apparently to carry crude oil, but the Army and Navy cannot use crude oil as such. Oil men want to know where the oil will be refined; by whom it is to be refined; to whom the refined products are to be sold, and where they are to be sold. Do the services propose to enter into processing contracts with refiners, whereby crude oil owned by the military is to be refined in exchange for some part of the products? Or do they propose to sell crude oil in the open-world market and continue to purchase refined products in the open market? Will the government-owned crude oil be brought into the United States, and if so, will there be a tariff, and how much?

Some oil men, recalling the early success of the submarine campaign along our Atlantic coast line in the early part of this war, wonder how the military proposes to assure wartime access to oil supplies in the Mediterranean. Others think that Secretary Ickes' reference to "obligations which this country must assume for the maintenance of collective security in the postwar world" may mean that this country intends to maintain postwar naval and air bases in the eastern Mediterranean.

State, county and school-district officials in the oil-producing states join with domestic oil producers in wondering how the federal Government's policies are going to affect the price of oil—and the taxation revenue that is so important to these local governmental units in the oil regions. They are frankly puzzled at the concern which the federal Government displays about domestic-oil resources, while this same Government refuses to permit the time-proven method of price increase to be tested.

Oil men in general find it bewildering to be told that a crude-price increase would be inflationary; while the same Government proposes to spend hundreds of millions of dollars to develop oil in foreign countries. They point out that while technically the Government is not actually engaged in the production of oil, the pipe-line-contract terms in effect give the Government control over exploration and production policies of the private companies.

They point out that the foreign policy of the U. S. Government is about to be determined on the basis that domestic-oil reserves are being liquidated. But the government agencies controlling price have refused to concede that any price increase would stimulate the discovery rate of these reserves. This amounts to a statement by the Government that the present profits of domestic-oil producers are ficticious—a liquidation of capital, because the producers cannot replace their present production. Producers concede that they are not able to replace their present production at present prices. But they refuse to concede that it cannot be replaced at higher prices to compensate for higher risks.

Some oil men point rather ruefully at the fact that no matter which idea is correct, they are being taxed at wartime rates on so-called profits which are not profits but results of sale of merchandise which cannot be replaced at the price for which it is being sold. The idea has even been suggested that if a price increase is inflationary, then the statutory depletion allowance could be raised substantially.

Government's Bargaining Position

Those who oppose any form of government participation in direct operations point out that Government uses its power and influence to drive harsh bargains. In effect, under the proposed pipe-line contract, the Government merely acts as a banker, making a loan. The companies will probably do all the construction work or let and supervise all contracts at actual cost. If usual government paring prevails, the companies will find that only direct costs will be allowed and that a substantial amount of administrative and overhead cost will come out of their own treasury. The Government gets a guarantee that its money will be repaid with interest and a profit.

In return for acting as banker, the Government has extracted a guaranteed minimum tender of oil to the line. That means that regardless of future tanker developments, possible markets eastward via Persian Gulf and Red Sea, and regardless of how low tanker rates may go, the pipe line must be kept filled at a tariff high enough to guarantee the Government a return of capital plus a profit. Furthermore, the Government

has demanded and obtained a monopoly on all pipe-line construction to the Mediterranean. No one can come in and build a competing line, unless the Government voluntarily permits such construction and refuses to build additional capacity for its own account.

In addition, the Government has an option on 30 million barrels of oil per year at a 25 per cent discount under the market price. The option runs at Government's choice for 50 years, covering a billion-barrel total or 20 per cent of the proved reserves, whichever is the lesser figure. Thirty million barrels per year equals 82,192 bbl. per day and any company controlling that much crude oil is definitely in a class with the major oil companies. The Government proposes to assure itself of that much oil at 25 per cent under the posted market price, which oil men say puts the Government in normal times in a position to break the price by selling its oil below the market. With the market price broken, the Government's contract price would be automatically reduced. If Government so desired, it could again sell its crude oil below the market and break the price structure once more.

Price-Control Position

In effect, therefore, in normal times when supply and demand are reasonably balanced, the Government through this deal, can actually control the world price for crude oil. Perhaps more interesting to smaller oil producers is government power to control domestic-crude prices within the United States without openly appearing to do so. Obviously, no Government would dare ask for continuation of the powers of OPA beyond the war emergency. So far as crude oil is concerned, this deal will generally permit the Government to maintain effective price ceilings in the post-war period.

There are kind words for private industry in Secretary Ickes' statement, but no promise, not even a qualified promise, that PRC will refrain from exercising any of its powers to engage in any of the other branches of petroleum operations that are permitted under the terms of its charter. The Government can build a refinery anywhere outside the United States with the assurance that its crude supply will be available at 25 per cent under the posted price, and with the power in normal periods to break that price to its own advantage. Thus, a government engaged in the refining business might enter into long-term contracts for refined products at current prices; then, by selling enough crude oil, break the market price of crude, which would automatically reduce the price at which it purchased its crude oil under this contract. Some refiners think the Government could do this fairly often without much risk under the proposed contract, if it chose to enter into the refining business.

Refiners believe that the the Government with a foreign refinery and crude oil available at 25 per cent under the market, could undercut the price of refined products outside the United States at any time it desired, especially since losses would be absorbed by the U. S. Treasury. If the American refiners were still in the export business, price cuts outside the United States would promptly react on the domestic market. The United States will probably continue to export refined products for several years, therefore the Government, through such operations, could in effect put a price ceiling on refined products inside the United States. This would simply reinforce the price-ceiling control that would exist also through ability to control the price of crude oil, thereby giving PRC in perpetuity most of the powers now exercised by the OPA.

Once it was realized how vast the powers of PRC were over petroleum prices in the United States, every administration would be subject to political pressure from every section of the United States. States which are large consumers of petroleum products, but not producers, would be interested in the lowest possible prices. States which are substantial producers of petroleum or in which refining was an important industry would be interested in high prices for crude, or perhaps low prices for crude and high prices for refined products. Normal economic laws would cease to function in so far as the petroleum industry was concerned. Instead there would be a series of shifts dependent solely on the relative political influence of the various sections of this country at the particular time.

Full Argument Welcomed

Oil men generally feel that when Congress examines the whole oil problem and all the ramifications of foreign policy that are involved, representatives will find much support for the industry's position that direct government participation is unnecessary. The petroleum industry asserts that, despite every handicap, through its private initiative, it has found and produced oil throughout the world. All that the industry asks of Government is a guarantee of a continuing foreign policy of support of the industry in its foreign operations so long as the industry carries on its relations fairly and equitably to all concerned.

They feel that if the Government is going to inaugurate and maintain, regardless of political administration changes, a foreign policy of strong

Deegan Joins Journal Editorial Staff

CHARLES J. DEEGAN, who for the past 2 years has been connected with the Petroleum Administration for War with headquarters in Washington, has joined The Oil and Gas Journal staff as associate editor.

Deegan brings to the Journal years of experience in the exploration, engineering, and economic phases of petroleum operations. Following his graduation from the University of Pittsburgh with a degree in petroleum engineering he was a member of the geological staff of the Empire Gas & Fuel Co. until 1925. In that year he became affiliated with the geological organization of the Marland Oil Co. and continued with that company until 1929. In 1929 and in 1930 he was engaged in petroleum engineering consulting activities.

From 1930 to 1941 Deegan was engaged in tax and engineering work for Continental Oil Co. with headquarters in Ponca City. In this and in previous employment he obtained a thorough knowledge of the geological and engineering practices and allied activities of the petroleum industry.

In October 1941 he became a member of the staff of Ralph K. Davies, deputy administrator. Later he was connected with the public-relations department and more recently was a member of the Program and Planning Division staff.

CHARLES J. DEEGAN

Deegan is in charge of the exploration and drilling department of the Journal.

support of its nationals when engaged in foreign operations, no further government participation is necessary.

If the Government is not going to inaugurate and maintain, regardless of political administration changes, a foreign policy of strong support of its nationals, then direct government participation in the oil business will mean only that government as well as private industry will lose money when other nationals with the aid of their government, freeze out or confiscate American oil interests.

The so-called necessity of creating a government-owned oil reserve against future war requirements is a fallacy, operators declare. In time of war, the petroleum resources of American citizens have always been freely available to the military forces of the United States to whatever extent the services were able to protect them from enemy action.

Productive Capacity Continues Slump; PAW Reduces March Quota

WASHINGTON, D. C. — Declining productive capacity in eastern and middle western states and in California was reflected this week in the net decrease of 2,500 bbl. in daily production quotas assigned the various oil states in March by the Petroleum Administration for War.

The national production quota of 4,698,900 bbl. daily for all petroleum liquids next month includes a static figure for District 3, a 1,400-bbl. rise in District 4 and decrease in Districts 1, 2 and 5.

From Austin, Tex., came reports that purchasers of crude oil were having difficulty in arranging tank cars for overland movement to eastern customers. Several purchasers requested reductions in allowables for certain fields in West Texas and East Texas, asserting that current runs result in adding crude to storage. The Texas Railroad Commission, however, set the March allowable at a net level of 2,023,324 bbl. daily, including an estimated yield of 137,847 bbl. daily of natural gasoline, condensate and allied products. The Texas allowable crude-oil production next month is 1,885,477 bbl. daily.

In District 4, PAW raised the quota assigned to Wyoming 1,400 bbl. per day. This upward revision was made to balance production against the increased demand for black oil from fields in the northern part of the state.

Certified daily rates of production for each state during March compared with actual output in the same month last year are given in the accompanying table.

PRODUCTION RATES IN BARRELS PER CALENDAR DAY

	March 1944	
	Certified total petroleum liquids	Estimated natural gasoline and condensate
District 1:		
New York	13,400	.....
Pennsylvania	42,300	1,300
West Virginia	15,800	7,000
Total	71,500	8,300
District 2:		
Illinois	228,000	13,000
Indiana	13,600	.....
Kansas	291,000	6,000
Kentucky	26,800	2,800
Michigan	52,300	300
Nebraska	1,000	.....
Ohio	9,800	600
Oklahoma	355,000	27,000
Total	977,300	49,700
District 3:		
Arkansas	81,700	5,000
Louisiana	375,700	23,000
Mississippi	46,000	.....
New Mexico	116,600	4,900
Texas	2,018,000	127,000
Total	2,638,000	164,900
District 4:		
Colorado	7,000	.....
Montana	24,300	300
Wyoming	100,200	7,200
Total	131,500	7,500
District 5:		
California	880,600	47,200
Total	4,698,900	277,600

Incentive Plan for Oil Expected Soon

WASHINGTON, D. C.—A break in the stalemate over crude-oil prices and production incentives is expected in the near future. The Senate committee on banking and currency has created a subcommittee to hold hearings on the subject, and the Office of Price Administration has completed the outlines of several possible "incentive plans" short of a general price increase.

Chairman Robert F. Wagner of New York of the full committee will head the oil price subcommittee, and other members are Senators George L. Radcliffe of Maryland, Francis Maloney of Connecticut, John L. McClellan of Arkansas, D. Worth Clark of Idaho, Charles W. Tobey of New Hampshire, John A. Danaher of Connecticut, and Robert A. Taft of Ohio. No date has yet been set for hearings.

The OPA this week reviewed its proposals with several representatives of oil producers and prepared to transmit its recommendations to James F. Byrnes, director of the Office of Economic Administration. It is expected that the OES will study the OPA proposals and then direct OPA to prepare details on whatever plan appears most feasible. OPA hopes to have a definite program for stimulating crude-oil production ready for presentation before the Wagner committee. Legislation probably would be required to put any such plan into effect, because it would involve some form of selective treatment.

Rio Bravo Properties Sold to D. D. Feldman

DALLAS, Tex.—D. D. Feldman acquired, February 16, all producing and nonproducing properties of the Rio Bravo Oil Co., as well as all equipment and four drilling rigs. The Rio Bravo Oil Co. was a subsidiary of the Southern Pacific Railroad with well over 1,000 bbl. a day production.

The Rio Bravo company is one of the oldest companies in Texas, having been in the oil-production business since 1913. John Suman, now vice president in charge of production for the Humble Oil & Refining Co., was its former general manager.

There are 137,000 acres involved in the deal of which some 50,000 acres are in fee simple. Feldman must drill 15 exploratory wells in 2 years. Consideration was several million dollars.

Special Hearings Announced By Arkansas Commission

EL DORADO, Ark.—The Arkansas Oil and Gas Commission has set March 13 as the date for a special hearing on (1) field rules for the Wisinger area of Miller County; (2) unitization of the north half of the northeast quarter of 22-18-22, Macedonia field, Columbia County, under petition of the Magnolia Petroleum Co.; (3) permanent order fixing unit size and acreage to be used for allocation of production purposes for Lion Oil Refining Co., Dickens B-1, Dorcheat field, Columbia County; (4) recognizing larger proration units than the 80 acres now fixed in the Dorcheat-Macedonia field of Columbia County; (5) evidence from Arkansas Louisiana Gas Co., purchaser of natural gas in the Dorcheat-Macedonia area, as to its recommendation for a system of proration that will prevent waste and assure ratable take of natural gas in this area.

Net Decline of 18.6 Million Barrels Shown In Reserves by A.P.I. Annual Report

by John P. O'Donnell

NEW YORK.—A net decline of 18,641,000 bbl. in the proven reserves of crude oil was shown here this week in the American Petroleum Institute's annual estimate of the nation's petroleum inventory which covers data as of January 1, 1944.

New reserves discovered in 1943, including new fields and new pays, totaled 282,418,000 bbl., the A.P.I. committee concluded. Revisions in previous estimates and extensions to old fields accounted for an upward adjustment in proven reserves of 1,202,368,000 bbl. The combination of newly discovered reserves and upward revisions to previous estimates totaled 1,484,786,000 bbl., compared to production of 1,503,427,000 bbl. The A.P.I. figures compare with Journal estimates of 212,145,000 bbl. of newly discovered oil in 1944 and extensions to old fields of 584,487,000 bbl.

The A.P.I. annual estimate on reserves proven by new fields and newly discovered pays during 1943 correlates closely with conclusions of the Journal's survey a month ago. The A.P.I. estimate of 282,418,000 bbl. of newly discovered oil represents 18 per cent of last year's production while the Journal figure of 212,145,000 bbl. was 14.3 per cent.

The committee, headed by J. Edgar Pew, vice president of Sun Oil Co., emphasized again that its estimates apply solely to proved or block-out reserves of crude oil and condensate known to be recoverable under existing economic operating conditions.

"New discoveries," the committee pointed out, "are seldom fully developed in the first year and in fact for several years thereafter. In this report estimates of newly discovered oil, therefore, necessarily represent but a part of the oil reserves which may ultimately be assigned to the new reservoirs discovered each year. The total of new oil estimated in this way in any given year will be comparatively small and the total of new oil through extensions comparatively large."

TABLE 1—ESTIMATED PROVED PETROLEUM RESERVES IN THE UNITED STATES
(Thousands of barrels)

	Proved reserves as of Jan. 1, 1943	Extensions and revisions during 1943	New reserves discovered in 1943*	Production during 1943 (estimated)	Proved reserves as of Jan. 1, 1944
Arkansas	300,026	21,995	2,536	27,628	296,929
California	3,195,846	408,993	16,170	284,186	3,336,823
Colorado	39,443	7,986	.....	2,328	45,111
Illinois	306,778	65,803	4,226	82,185	294,622
Indiana	31,773	4,258	272	5,264	31,039
Kansas	686,975	19,772	45,352	106,247	645,852
Kentucky	34,653	4,650	3,815	7,928	35,190
Louisiana	1,442,126	111,984	53,491	123,775	1,483,826
Michigan	63,843	6,187	5,900	20,682	55,248
Mississippi	40,897	14,397	2,468	18,890	38,872
Montana	85,558	30,123	200	7,824	108,057
Nebraska	2,177	—523	.....	654	1,000
New Mexico	677,497	13,801	1,140	38,457	653,981
New York	54,395	41,180	.....	5,050	90,525
Ohio	35,021	—600	1,527	3,305	32,643
Oklahoma	968,927	12,194	50,524	123,027	908,618
Pennsylvania	153,118	.....	.....	15,795	137,323
Texas	11,545,727	283,823	88,969	593,565	11,324,954
West Virginia	47,187	.....	.....	3,348	43,839
Wyoming	370,572	156,335	5,728	33,241	499,394
Miscellaneous†	254	.....	100	48	306
Total United States	20,082,793	1,202,368	282,418	1,503,427	20,064,152

*Only a limited area is assigned to each new discovery even though the committee may believe that eventually a much larger area will produce, for in this report we are concerned only with actually proved reserves. †Includes Florida, Missouri, Tennessee, Utah and Virginia.

TABLE 2—SUMMARY OF COMMITTEE'S ANNUAL REPORTS COVERING PERIOD 1937-1943
(Thousands of barrels)

Year—	New oil blocked out during year: Through revisions of previous estimates and extensions	Through new pools discovered during year	Total through new discoveries, extensions and revisions	Production during year	Estimated proved reserves as of end of year
1936	.....	.....	.....	.....	13,063,400
1937	2,792,790	928,742	3,721,532	1,277,664	15,507,268
1938	2,243,571	810,493	3,054,064	1,213,186	17,348,146
1939	2,058,455	340,667	2,399,122	1,264,256	18,483,012
1940	1,807,012	286,338	1,893,350	1,351,847	19,024,515
1941	1,538,989	429,974	1,968,963	1,404,182	19,589,296
1942	1,616,925	260,051	1,876,976	1,385,479	20,082,793
1943	1,202,368	282,418	1,484,786	1,503,427	20,064,152

Franklin Leaves PAW Staff To Run for U. S. Senate

Wirt Franklin has resigned as special assistant to the petroleum administrator for war to enter the race in Oklahoma for the Republican nomination for United States senator. Franklin's home is in Ardmore, Okla., and for many years he was an independent oil operator in that state. He was one of the organizers and the first president of the Independent Petroleum Association of America.

Columbia Crude Production Up 26 Per Cent for Year

WASHINGTON, D. C.—Production of crude petroleum in Colombia during 1943 totaled 13,261,065 bbl., an increase of 26 per cent compared with 1942, according to the Department of Commerce. Refineries delivered a higher grade of lubricating oil than formerly and supplied all of the aviation gasoline used by the Government. Bidding on national oil concessions was active, and of the 82 applications filed 8 culminated in contracts and 20 more were approved in 1944.

President of I.P.A.A. Denounces Arabian Pipe-Line Project

BRADFORD, Pa.—"I am going to do everything in my power as president of the Independent Petroleum Association to kill the Petroleum Reserves Corporation as now constituted," declared Ralph T. Zook at a dinner meeting last week of the Bradford District Oil Producers Association. His statement was provoked by the PRC proposal to build an Arabian pipe line to move oil from Middle East fields to the eastern shore of the Mediterranean.

"This venture could be of no aid in our No. 1 job of winning the war," said the head of the I.P.A. "It would contribute no oil supply either to the military program of the United Nations or to the consumers of the United States. The project could not be completed in less than 2 years, unless we made war a secondary matter and concentrated all possible effort on this project.

"It is a postwar enterprise, except that the official statement would indicate it is to be started soon. That would mean that all important shipping space would de diverted to the movement of supplies to Arabia. With a manpower shortage here at home, many hundreds would be sought for the pipe-line job. Steel mills would be asked to use part of their capacity to make the pipe.

"The oil supply of this country has always been provided through the efforts of private business. Here we have the first step toward a government-managed oil industry. Thousands of oil operators, land owners and employes in the industry in the United States would lose through the activity of a government corporation paying no taxes and supported by taxes collected here at home. The oil industry would pay taxes to finance the means of putting itself out of business.

"Our oil-producing industry in the United States has been running at half speed for two years so far as development and exploratory work is concerned. Through rationing of materials and freezing of prices expansion of activity was prevented. Now, after denying steel for drilling wells to improve oil supply from our fields, it is proposed to take thousands of tons of steel out of the limited supply and use it 6,000 miles from home.

"The asserted justification for this pipe line is that we have about run out of oil in the United States. This view is not shared by oil men. From the beginning of the oil industry, it has been necessary to keep on exploring. We will continue to find oil if we drill for it. The bombs at Pearl Harbor did not bring an end to the oil possibilities in the northern hemisphere, the natural area in which to build our reserves for our nationals and for the protection of the United States in time of war, despite the defeatist tone recently adopted by some outside the oil industry."

Petroleum Butadiene Is Economically Competitive With Natural Rubber

WASHINGTON, D. C.—Synthetic rubber can be produced from petroleum butadiene at from 12 to 25 cents per pound and can compete with natural rubber after the war, in the opinion of Stanley T. Crossland, vice president of the Rubber Reserve Co.

Testifying before the House committee on the appropriation bill for the Department of Commerce and Reconstruction Finance Corp., Crossland said that the various plants in the Government's synthetic-rubber program have different costs but the lowest-cost plants might compete with natural at 15 cents per pound, as compared with the prewar price of 22½ cents for crude.

"If we use alcohol at 90 cents a gallon," he said, "synthetic rubber will cost somewhere between 40 and 45 cents a pound; if we use the butylenes from petroleum in making butadiene, at 9 cents a gallon, we should be able to make synthetic rubber for somewhere between 20 and 25 cents a pound. That is without charging amortization for the plants. If we use the cheapest materials we will have to make and put in the plant, we can compete with crude rubber at around 15 cents. Unfortunately, all plants will not have the same production costs, so that will vary. If we can make butadiene at 8 cents a pound and styrene at 8 cents a pound, we can make crude synthetic rubber for around 12 or 14 cents a pound."

The synthetic-rubber program is not coming along as well as desired, Crossland said, but by July 1 will be producing about 60,000 tons of buna-S type a month, 4,000 tons of neoprene, and about 2,000 tons of butyl. He said butadiene is still short because not enough producing facilities are in operation and there is some difficulty in obtaining sufficient butane and butylene feed stocks.

At the request of the committee, Crossland presented a table showing the cost and status of all facilities in the synthetic-rubber program, showing that the estimated total cost will be $730,124,554, including $55,000,000 in new additions and changes in previously authorized plants.

LIST OF PROJECTS IN SYNTHETIC-RUBBER PROGRAM
(In short tons)

Operator and plant location—	Estimated project cost	Designed capacity
Cities Service Co.:		
Lake Charles, La.	$15,000,000	55,000
Humble Oil & Ref. Co.:		
Baytown, Tex.	18,887,000	30,000
Ingleside, Tex.	4,100,000	12,500
Neches Butane Products Co.:		
Port Neches, Tex.	60,000,000	100,000
Phillips Petroleum Co.:		
Borger, Tex.	30,767,603	45,000
Shell Union Oil Corp.:		
Los Angeles, Calif.	16,916,000	55,000
Sinclair Rubber Co.:		
Houston, Tex.	30,000,000	50,000
Standard Oil of Calif.:		
El Segundo, Calif.	6,200,000	15,000
Standard Oil of La.:		
Baton Rouge, La.	9,579,325	15,000
Baton Rouge, La.	1,737,937	6,860
Sun Oil Co.:		
Toledo, Ohio	6,323,000	15,000
Taylor Ref. Co.:		
Corpus Christi, Tex.	1,400,000	5,500
Eastern States Pet. Co.:		
Houston, Tex.	3,641,000	12,800
Lion Oil & Ref. Co.:		
El Dorado, Ark.	2,101,300	6,700
Southern Calif. Gas Co.:		
Los Angeles, Calif.	7,732,300	30,000

Stanolind Stores Oil in West Texas 16-in. Outlet

To relieve storage congestion in West Texas, Stanolind Pipe Line Co. is running crude oil into the 385-mile 16-in. line under construction from Slaughter, Tex., to Drumright, Okla. Oil will fill a 42½-mile section of the line extending east from Slaughter.

Pipe is being laid at the rate of 5 to 6 miles per day to finish 83 miles of incomplete sections before March 15. Three 85,000-bbl. tanks, belonging to Stanolind Oil Purchasing Co. have been filled; a fourth is being filled.

Carter Extends Benefits

Additional benefits for all employes serving in the armed forces were announced by The Carter Oil Co., Tulsa, last week. Employes on military leave who are granted a medical discharge from the armed forces and are unable to return to work will now be eligible for sickness benefits based on their accredited service.

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

In Right Direction

THE decision to have a representative Senate committee to make "a full and complete study" of the world's petroleum resources "in relation to our national welfare and security" and the report of the Truman committee are steps in the right direction, looking to the adoption of a sound foreign oil policy for the postwar period.

The fact the American public, as represented by the daily press and other media, has either entirely ignored or confused the many issues involved in the mammoth pipe-line and allied projects of the Middle East indicates the necessity of having open hearings to arouse a people completely engrossed in winning a war and to bring home to them matters as vital to their future welfare as any that ever have confronted this nation.

It is apparent that millions of consumers are convinced that a permanent petroleum shortage exists in this country, and it is on the fears that arise from this belief that sponsors of governmental participation in oil operations here and abroad are largely backing their case. The average consumer still does not realize that petroleum rationing has been brought about entirely by the war's restrictions in operations. There is danger that he will support any program which he is led to believe will assure adequate petroleum supplies in the future, regardless of economic and political complications to him and to future generations. Never were there greater need and opportunity for sound legislative leadership than now.

While not professing to have all the answers as to what should be incorporated in a national oil policy for this country, the special subcommittee report of the Truman committee did reveal that a careful study had been made. It is significant and a sincere tribute to the petroleum industry that the report stated: "In arriving at policy decisions of such magnitude that they will affect our future security for decades to come, both the legislative and executive branches of our Government should seek the practical counsel and advice of business men in the oil industry, particularly those with foreign experience. Their enterprise has helped to bring us this close to victory and their judgment can be considered with profit . . ."

The subcommittee, while making no final recommendation, did suggest an approach around which a sound policy can be evolved. It consists in full diplomatic support for our nationals, as private operators, in their efforts to find and develop petroleum resources outside this country.

Too often in the past official actions have reflected a weak and antagonistic position necesitating arrangements under which our foreign oil operators have acted alone or were forced to look to other countries for the backing they should have had from their own government.

This situation can no longer be tolerated. Petroleum is too vital to our freedom and to our economy not to have the aggressive support of a Government whose people for many years to come will continue to consume most of the world's petroleum.

In the current situation this should mean that the Government now and later will exercise whatever powers are needed to assure the carrying out of agreements under which our nationals are developing large oil reserves in the Middle East. The assured complications of governmental participation will be avoided, and the world's petroleum operations will continue to center in the accomplishments of free enterprise in this country.

Postwar Economic Problems and Technical Discussions Share Time Before A.I.M.E.

by John P. O'Donnell

NEW YORK.—Many of the postwar problems of the oil industry were considered in detail during sessions of the petroleum division of the American Institute of Mining and Metallurgical Engineers which is holding its 160th annual meeting here this week. Postwar topics were discussed in three-quarters of the papers presented during the division's economic sessions which followed the usual array of production-technology papers and the foreign and domestic symposiums and closed the meeting so far as oil men were concerned.

Problems concerned with the supply, distribution and consumption of petroleum after the war, the foreign oil policy of the United States, the discovery of new reserves and the effect of the rapidly expanding catalytic cracking capacity on fuels in postwar years were among the subjects raised for discussion during the economics session. Others on capital investment in the industry were also presented during this session.

Pratt Dinner Speaker

One of the highlights of the petroleum division sessions was the annual dinner meeting which was addressed by Wallace F. Pratt, vice president of the Standard Oil Co. (New Jersey). C. A. Warner, Houston Oil Co., retiring division chairman, presided at the dinner which drew a record attendance.

Another petroleum division highlight was the presentation of the Anthony F. Lucas Medal to Charles Van Ormer Millikan, chief engineer for the Amerada Petroleum Corp., Tulsa. The presentation was made at the all-institute dinner at the Waldorf-Astoria. The citation accompanying the award recognized Millikan "for his outstanding contributions to engineering in the development and production of petroleum. For his studies of reservoir behavior and his many published papers advancing the art of reservoir control. For his work in appreciating the need for an instrument capable of determining bottom-hole pressures, in developing a gage for recording bottom-hole pressures, and in teaching its use. For his long and effective service to the institute in the petroleum division."

Winfield S. Morris, vice president and general manager, East Texas Salt Water Disposal Co., Kilgore, will head the petroleum division this year as chairman. Other division officers are Stuart E. Buckley, acting head, production research department, Humble Oil & Refining Co., Houston, associate chairman; H. F. Beardmore, production engineer, Barnsdall Oil Co., Tulsa, and Comdr. Victor H. Wilhelm, U.S. N.R., assistant inspector, Naval Petroleum Reserves in California, Los Angeles, regional vice chairmen, and Harold Vance, head, petroleum engineering department, Texas A. & M., College Station, Tex., secretary-treasurer.

Chairmen of standing committees for this year are: B. C. Craft, professor of petroleum engineering, Louisiana State University, University, La., for papers and programs; K. A. Covell, Pure Oil Co., Fort Worth, for production engineering; Winthrop P. Haynes, geologist, Standard Oil Co. (New Jersey), for production; Norman D. Fitzgerald, engineering economist, Great Lakes Carbon Co., New York, for economics; A. G. Loomis, head, petroleum production research and assistant director of laboratories, Shell Development Co., Emeryville, Calif., for engineering research.

Miller Chairman for Refining

Walter Miller, vice president, Continental Oil Co., Ponca City, Okla., for refinery engineering; H. H. Power, professor, petroleum engineering, University of Texas, Austin, for education; Ludwig W. Blau, head of geophysics and production research, Humble Oil & Refining Co., Houston, for geophysics; F. B. Plummer, geologist, Bureau of Economic Geology, University of Texas, Austin, for production geology; M. L. Haider, head, production research and engineering department, Standard Oil Development Co., New York, for publications, and P. E. Fitzgerald, research geologist, Dowell, Inc., Tulsa, for membership.

Two oil men were elected to the institute's board: Pratt and John R. Suman. Suman is vice president of the Humble Oil & Refining Co. and

W. S. Morris, C. V. Millikan, F. W. Jessen and F. W. Rolhausen were among program participants at the annual A.I.M.E., Petroleum Division, meeting. Morris is the new division chairman; Millikan received the Lucas medal, Jessen and Rolhausen were coauthors of a paper

the recipient of the Lucas Medal in 1943.

The subject of petroleum engineering education was introduced as a topic for general discussion for the first time at the opening petroleum division session. It was discussed in papers presented by Vance, and by George W. Brown and Donald Katz, both of the University of Michigan.

Conversion of Big-Inch Lines to Gas Advocated by Swensrud

NEW YORK.—Conversion of one or both of the War Emergency Pipelines, Inc. big-inch lines to natural-gas transmission service was advanced here this week as a possible solution to one of the petroleum industry's most vital postwar problems. Economic attractiveness of the plan which already had received broad consideration within the industry but with much less specific detail was outlined here February 23 by Sidney A. Swensrud, vice president of The Standard Oil Co. (Ohio) in an address before the annual meeting, American Institute of Mining and Metallurgical Engineers, Petroleum Division.

Postwar use of the lines for movement of crude oil and products, Swensrud pointed out, presents many complications, especially if there are enough or more than enough tankers to handle the Gulf Coast-East Coast oil movements after the war.

Swensrud presented an exhaustive analysis of natural-gas supplies and reserves on the Texas Gulf Coast. He showed conclusively that the eastern market could absorb the entire deliverable capacity of both big-inch lines converted to natural-gas transmission and presented data, showing that economic aspects of the question invite conversion as a permanent solution to the question of what to do with the emergency lines. He said gas could be delivered to eastern distributing systems at a cost of 23 to 26 cents per 1,000 cu. ft.

Excerpts from his paper follow:

The cost of operation and the capacities of the lines would depend mainly upon the number of compressor stations and the discharge and suction pressures at which they were operated. Compressor stations on a gas line, for engineering and economic reasons, are usually spaced farther apart than the pumping stations on an oil line.

With respect to pressure, the wall thickness and other specifications of the 24 and 20-in. lines should permit operating at compressor station discharge pressures of well above 800 lb. per sq. in. according to accepted gas pipe-line design practice. For the purpose of this study, however, we have assumed discharge pressures of 800 lb. per sq. in.

As will be seen in Table 1, the direct throughput costs tend to increase, as stations are placed closer together, more rapidly than does the throughput capacity, this for the reason that the closer the stations are spaced the greater number of times the gas has to be recompressed. Such increased stations also, of course, add to the investment and in the figures presented herewith the depreciation and return on investment figures have been adjusted to reflect this factor.

Stations Regulate Capacity

With additional stations, the throughput capacity increases at a somewhat faster rate, however, than the additional investment, so that the indirect costs per unit of throughput tend to decline with increased stations down to a certain point. The result is that with increasing direct and decreasing indirect costs per unit of throughput, the total cost per unit decreases down to a minimum at the 100-mile spacing, as seen in the table. For station spacing as close as 80 miles, however, the total of the direct and indirect costs are shown to increase moderately as against the 100-mile spacing. This would not necessarily condemn the closer spacing, however, if the extra throughput capacity were needed as for example to meet peak load demands.

The direct expenses of operation consist primarily of fuel and labor, with lesser amounts for other items such as lubricating oil, repair parts, etc. The natural gas itself would be by far the cheapest source of power, hence the use of natural-gas engines has been assumed, and the gas used as fuel charged to expense at its estimated cost of 5 cents per 1,000 cu. ft.* In addition to these items, there are the ordinary property taxes. Also in addition to these direct costs, there would be the usual indirect costs of accounting, supervision and administion. Depreciation is not a current cash expense, but represents the deterioration or obsolescence of the physical facilities, which must be considered a cost if the capital investment is to be repaid or replaced out of the operating earnings.

Abstracts of several engineering papers presented before the sessions on petroleum technology during the A.I.M.E. meeting are published in the Engineering and Operating Section. They start on Page 97.

Value of Lines After Conversion

Return on the investment has been here included with expenses, inasmuch as the purpose of the table is to determine the total amount of revenue necessary to cover the expenses and yield a reasonable rate of return on the investment. Since only a part of such return (that is, the part represented by interest) would be an expense for income-tax purposes, it is, therefore, necessary to provide for income taxes on the balance, which is here done by including a sufficiently large figure for gross return on investment so that after normal income taxes it would leave a reasonable net return.

With respect to the investment value basis for calculating depreciation and return on investment, the writer has reached the conclusion, after considerable thought and consideration of the matter, that for the purpose of this study the soundest assumption as to the value of the lines, after conversion to gas service, on which to base depreciation and return on investment would be the cost in the postwar period of building the equivalent gas-transmission capacity, and deducting therefrom such amount as might appear applicable to represent the physical depreciation of the lines which had occurred up to that time.

It is to be borne in mind that we are dealing here not with an ordinary problem of valuation in which the preservation of an original investment still being used for its original purpose must be considered; we are dealing here with valuation from a gas-transmission standpoint of facilities which were built for quite a different purpose as a wartime emergency project.

The postwar cost of a 24-in. gas line of about 1,700 miles in length, with stations approximately 100 miles apart, is estimated to be in the neigh-

*Transportation cost on the gas used as fuel has not been included as an expense because the throughput has been calculated on the basis of the net quantities delivered at destination after deducting the quantities removed en route for fuel.

borhood of 75 million dollars. This figure has been arrived at by careful consideration of steel, equipment and construction costs, and on the basis of known or estimated cost data for large-diameter lines which have been built or projected. It is estimated that postwar material and construction costs of this type should be at least 15 to 25 per cent below wartime costs, which, of course, have been exceedingly high.

Value of Converted 20-in.

With respect to the 20-in. line, the value after conversion to gas has been assumed to be approximately 62 per cent of that arrived at as above for the 24-in. line, this percentage being the approximate proportion of the capacity of a 20-in. line to that of a 24-in. line. Actually the cost of a 20-in. line would be somewhat higher than 62 per cent of the cost of a 24-in. line (the steel cost would be approximately 70 per cent) but a line as small as 20 in. in diameter would ordinarily not be built for large volume, long distance movements of gas, hence it is here valued on the basis of its capacity in relation to a more efficient or economical size of line, rather than on the basis of the cost of reproduction. The difference is not great, but the qualification nevertheless seems a valid one under the circumstances.

On the basis of the 62 per cent figure, the value of the 20-in. line after conversion might then be said to be in the order of $46,000,000, and the two lines together, a total of say $121,000,000.

An alternative way of arriving at some valuation figure for purposes of depreciation and return on investment might be to take the original cost of the lines less the amount which might reasonably be deducted or written off therefrom to represent wartime amortization, and add to this remainer the cost of converting to gas, less the salvage or residual value of the original pumping stations which would not be needed for gas. The lines were, of course, built at high costs during the war and had they been built privately they would have been subject to short-term amortization. If we assume such amortization at 20 per cent a year, and if we assume further that at the end of the emergency or at the time of conversion the lines on the average were say two to three years old, then such writeoff or amortization might be assumed to have accumulated to the extent of 40 to 50 per cent. Applying this to an original cost for both lines of say $135,000,000 would leave a remainder of around 70 to 75 million dollars, say $73,000,000. To this would then have to be added the cost of converting the lines to gas. The 24-in. line would have to be extended from its southern end a distance of several hundred miles to connect with existing large gas reserves. The same would be true to a much lesser extent of the 20-in. line. At the destination end, connections would have to be made with the distributing systems, which although involving relatively little mileage, would tend to be high-cost type of construction. Also, of course, new compressor stations would have to be built. Substantially all of the present facilities could be utilized except the pumping stations, and probably some of the present station sites might be used for compressor stations where the spacing worked out satisfactorily. The present pumping equipment could, of course, be salvaged, or conceivably it might be deemed desirable to keep it available for future possible need in time of another emergency, in which case its value could be considered a military rather than an economic one, the same as a battleship or a second Panama Canal.

Just what the most practical construction at the southwestern ends of the lines would be to connect them to existing available gas reserves would depend upon the gas fields that were to be connected, whether both lines were to be converted, and whether the 16-in. line presently being used for products from Corpus Christi to Houston in connection with the 20-in. line would be available after conversion to gas. If both lines were to be extended into the same gas area, then it seems probable that it would be preferable to build one larger capacity line over the part of the route which was common to both lines, than to build two separate lines. Also, if both lines were to be used, then where they already follow the same route some economy would doubtless be achieved in combining compressor station locations and the like.

Cost of 24-in. Extension

It is not possible in this paper to give detailed consideration to all of these aspects of conversion, but it has been estimated that to provide several hundred miles of line extension on the 24-in., build compressor stations 100 miles apart, and allow several million dollars for new construction at the eastern end probably would add up to a total of somewhere in the neighborhood of 33 to 38 million dollars, say $36,000,000; and for the 20-in. a similar figure of approximately 16 to 20 million dollars, say $18,000,000 would appear

TABLE I—ESTIMATED ANNUAL COSTS OF TRANSPORTING NATURAL GAS THROUGH WAR EMERGENCY 24 AND 20-IN. PIPE LINES WITH VARIOUS STATION SPACINGS AND AT 75 PER CENT LOAD FACTOR

Average distance between stations (miles)	200		160		100		80	
Throughput: Millions cu. ft. a day	215		239		298		330	
Billions cu. ft. a year	78		88		109		120	
Est. value of investment at time of conversion, plus working capital	$108,000,000		$113,000,000		$125,000,000		$137,000,000	
	$000	Cents M.c.f.	$000	Cents M.c.u.	$000	Cents M.c.f.	$000	Cents M.c.f.
Direct operating and maintenance expense	2,600	3.3	3,200	3.6	5,300	4.9	6,950	5.8
Taxes (other than income) and administrative expense	2,300	3.0	2,470	2.8	2,750	2.5	3,000	2.5
Depreciation, 2.86 per cent	2,970	3.8	3,120	3.6	3,460	3.2	3,800	3.2
Amount required to yield 6.5 per cent return on value of investment	8,300	10.6	8,700	9.9	9,600	8.8	10,600	8.8
Total	16,170	20.7	17,490	19.9	21,110	19.4	24,350	20.3

TABLE II—ESTIMATED ANNUAL COSTS OF TRANSPORTING NATURAL GAS THROUGH 24 AND 20-IN. LINES COMBINED WITH 100-MILE STATION SPACING AND AT VARIOUS LOAD FACTORS

Load factor—	70 per cent		75 per cent		80 per cent		85 per cent	
Throughput—Billions CF a year	102		109		116		123	
	$000	Cents M.c.f.	$000	Cents M.c.f.	$000	Cents M.c.f.	$000	Cents M.c.f.
Direct operating and maintenance expense	5,200	5.1	5,300	4.9	5,400	4.6	5,500	4.5
Taxes (other than income) and administrative expense	2,750	2.7	2,750	2.5	2,750	2.4	2,750	2.2
Depreciation 2.86 per cent a year	3,460	3.4	3,460	3.2	3,460	3.0	3,460	2.8
Amount required to yield 6.5 per cent return on value of investment	9,600	9.4	9,600	8.8	9,600	8.3	9,600	7.8
Total for transportation	21,010	20.6	21,110	19.4	21,210	18.3	21,310	17.3
Cost of gas at source		5.0		5.0		5.0		5.0
Extra for storage, contingencies, etc.		0.5		0.5		0.5		0.5
Total delivered cost		26.1		24.9		23.8		22.8

reasonable, making a total of say $54,000,000. If the lines were consolidated, then the total expenditure probably would be somewhat less. Adding the $54,000,000 figure to the $73,000,000 referred to above, would give a total of $127,000,000, and if from this figure allowance is made for some residual value for the original pumping stations and equipment, we would get back to somewhere in the range of the figure arrived at (of $121,000,000) on the basis of estimating the value after conversion of the cost of duplicating in the postwar period the total transmission capacity represented by the two lines.

So much for the possible valuation bases on which to compute depreciation and return on investment. With respect to depreciation, it appears probable that rates based on a life of somewhere between 30 and 40 years would be allowed; if 35 years be assumed, the annual rate would be 2.86 per cent, which is the rate used in the accompanying tables.

Return on Investment

As for return on investment, the operations of the lines in question and the rates charged for their services, if converted to gas, presumably would be under the jurisdiction of the Federal Power Commission. Under that commission's decisions to date, its conception of a fair return on the value of the investment appears to be 6½ per cent, after deduction of income taxes allowed to be deducted for such purpose. There appears to be considerable doubt that the commission would approve rates high enough to yield 6½ per cent after all wartime excess profit taxes rather than merely the normal taxes. Since in the postwar period here under consideration, however, excess profit taxes presumably will not be continued, a 6½ per cent return after normal taxes only has been assumed. The total amount of revenue necessary to yield such a return depends, therefore, upon the proportion of funded debt and the rate of interest thereon (interest being an expense deduction before income tax), the rate of normal tax, and the rate of depreciation.

Under the Federal Power Commission's conception also, the total return permitted would tend to decline as depreciation accumulated to reduce the theoretical value of the investment. Over a 10-year period, on the basis of 2.86 per cent a year, the total depreciation would be approximately 28.6 per cent, so that over such 10-year period as a whole, the average investment on which the 6½ per cent rate could be earned, presumably would be something in the order of the original amount less one-half of the 28.6 per cent or less about 14 per cent. Or if we were to think in terms of a somewhat shorter period of between 5 and 10 years, say 7 years, then the average would be the original amount less about 10 per cent (½ of 7 by 2.86). Actually, in theory, of course, in order to remain within the 6½ per cent each year, the rates charged have to be adjusted downward from time to time to reflect the decline in investment. For the purpose of this study it has seemed advisable, however, to confine ourselves to the average situation over a period of intermediate duration, such as 7 years.

Normal income tax rates over say a 7-year period following the war presumably would also be lower than at present.

In order to simplify the calculations, the figures used in the accompanying table for total return on investment have been based upon the following assumptions: (1) that approximately two-thirds of the capital investment is represented by funded debt bearing 4 per cent interest; (2) that the figures are based upon an average value of 90 per cent of the original value, to give reflection on the basis of about a 7-year period to the factor of declining valuation resulting from depreciation, and (3) that the average normal income tax rate is 35 per cent.

On this basis, for the two lines combined the average investment on which the 6½ per cent might be earned, would be about $109,000,000 for the lines and to this would have to be added a reasonable amount, say four million dollars, for necessary working capital which would bring the total to $113,000,000. Two-thirds of this as funded debt would amount to about $75,000,000, involving (at 4 per cent) about $3,000,000 per year interest. To give a total return of 6½ per cent on $113,000,000 would require approximately $7,300,000 a year, so that a net of $4,300,000 would have to be returned on the equity money, and to yield this after 35 per cent income tax would require a profit, after interest but before income tax, of $6,600,000, which together with the $3,000,000 interest would make a total of $9,600,000, the total amount of earnings necessary to provide for a 6½ per cent return after normal income taxes on the average valuation over the 7-year period.

On the basis of the foregoing consideration of direct and indirect operating expenses, depreciation and return on investment, the figures in Table 1 have been prepared to show the estimated cost under various station spacings for the two lines on a combined basis. In each case the figures are based upon operating the lines at an average of 75 per cent of capacity, which provides a reasonable leeway for variation in load and for actual versus theoretically possible performance.

As seen from these figures, the lines could be designed to operate at a rather wide range of capacities, depending upon station spacings, at rates of from about 19.4 to 20.7 cents per 1,000 cu. ft. at a 75 per cent load factor.

Load Factors

In Table 2 it has been assumed that the lines have been converted to gas and that based upon the anticipated throughput and load factors, compressor stations had been built on an average of 100 miles apart. Load factors of 70, 75, 80 and 85 per cent have been used. In order to see what the total delivered cost of gas at the destination, under these various assumptions as to capacity utilization, would be, there is also added at the bottom of the table the assumed cost of the gas at the head of the line—that is 5 cents per 1,000 cu. ft.

There has also been added an arbitrary amount of 0.5 cent per 1,000 cu. ft. or about $500,000 to $600.000 per year to cover items such as storage in the Appalachian area and other contingent or unanticipated items which might arise. It seems conservative to allow for some substantial amount for such possible necessities.

As seen from the figures in Table 2, the lines could be operated down to an average of 70 per cent of their capacity without increasing the total delivered cost of the gas to more than approximately 26 cents per 1,000 cu. ft., and for each increase of 5 per cent in load factor, the delivered cost would be reduced by approximately 1 cent per 1,000 cu. ft., so that at 85 per cent load factor for example the delivered cost is indicated to be a little under 23 cents per 1,000 cu. ft.

The cost of delivering extra gas to the Appalachian area through otherwise idle capacity would, of course, be relatively low, as is evidenced by the fact that the direct operating and maintenance expense for delivery all the way to the East is seen in Table 2 to be only about 5 cents per 1,000 cu. ft., with stations 100 miles apart.

Pogue Shows Rising Cost of Finding Oil

REPLACEMENT costs in production of crude oil have shown a rising trend since 1937, according to Dr. Joseph E. Pogue, vice president of the Chase National Bank, and Frederick G. Coqueron of the bank's department of petroleum economics, who presented a detailed report on "Sources, Disposition, and Characteristics of the Capital Employed by 30 Oil Companies During 1934-1942." The report covered the operations of most of the major and semimajor companies of this country, including those with foreign operating facilities. Nine of the 30 companies were principally pro-

ducing companies, 4 with production in excess of refining capacity and 17 with refining capacity in excess of production.

The authors explained that "the data permit a rough approximation of finding and development cost—the cost of replacing with a developed barrel a barrel withdrawn. The method involves a number of assumptions, each of which introduces unknown errors, and yet the results, while far from definitive, may be indicative."

The analyses shows that the replacement cost climbed steadily starting with 26.9 cents per barrel in 1937 to 48.8 cents per barrel in 1941. The report gives the following comparisons for two periods (in millions of barrels):

	1937-39	1940-42
United States crude-oil production	3,758	4,142
Increase in proven reserves	5,420	1,600
Total	9,178	5,742
Estimated replacement cost (cents)	28.7	44.3

The several analyses of the operations of these companies reflected the wartime restrictions in drilling and production operations and the 1942 expansion in refining facilities for the manufacture of war products. The 30 companies accounted for 54 per cent of the nation's crude-oil output and 79 per cent of the crude oil run to stills.

The full effect of the first war year on capital expenditures is shown in the following table:

Division—	1942 vs. 9-year average
Production	—15.1
Transportation	+98.8
Refining	+161.3
Marketing	—30.5
All others	+140.9
Total	+18.0

During the period under review the rate of return on invested capital of the 30 companies averaged 6.4 per cent against an average of 8.6 per cent for over 1,100 manufacturing companies. Among the 30 companies the per cent return was largest among the strictly producing companies followed by the companies with production in excess of refinery output with the lowest return from the major companies which have refining capacity in excess of production.

Half of the companies have investments outside this country. As of December 31, 1942, the combined net investment in foreign countries was 424 million, 8.5 per cent of the total investment. During 1942 their foreign production averaged 285,000 bbl. daily, 13.7 per cent of their total, and foreign refining, 328,000 bbl. daily, 10.2 per cent of their total.

Following are additional conclusions of the authors' report:

The petroleum industry generates the capital needed for its expansion almost entirely from its own operations and is therefore a singularly self-contained economic unit.

The long-term debt contained in the financial structure of the industry is small relative to the total capital employed, is less than the net working capital, and has increased but slightly during the period under review.

The capital expenditures of the group of 30 oil companies for 9 years amounted to 6.1 billion dollars, 58.3 per cent of which went into crude-oil producing facilities. The trend of this segment of expenditures has been downward since 1937. In 1942, expenditures for refining facilities increased sharply and for marketing facilities declined drastically.

The net working capital of the group increased 380 million dollars over the period, and the industry is in a favorable position of liquidity. The ratio of combined current assets to current liabilities was 3.21 at the close of the period.

Cyclical Fluctuations in Net

The net income of the group displayed an upward trend for the period but with rather sharp cyclical fluctuations.

The group has paid out a relatively low percentage of net income in the form of dividends. For the period the average was 55 per cent of net income.

The rate of return on invested capital for the group averaged 6.4 per cent for the period, compared with an average of 8.8 per cent for a group of over 1,100 manufacturing companies. Integrated oil companies showed a lower rate of return than producing companies.

Combined net assets for the group totaled over 6 billion dollars at the end of 1942, of which 700 million dollars, or 12 per cent, were located outside the United States.

The combined net investment in properties, plant, and equipment of the group at December 31, 1942, was distributed in the divisions of the business as follows: Production, 45.6 per cent; transportation, 13.7 per cent; refining, 19.8 per cent; marketing, 18.7 per cent, and all other, 2.2 per cent.

The concentration of capital in large units is less than in many highly technological industries. The group in 1942 produced 54 per cent and refined 79 per cent of the totals for the country. Eighteen companies accounted for half of the nation's crude-oil production; and seven companies, for half of its refinery throughput.

The group increased its crude-oil production by 57 per cent and its refining throughput by 43 per cent between 1934 and 1942, as compared with an expansion of 25 per cent in gross fixed assets, 19 per cent in net fixed assets, and 11 per cent in borrowed and invested capital.

The combined statements indicate that the oil economy is functioning soundly and effectively.

DEATHS

Courtenay Marshall, secretary of Magnolia Petroleum Co. from 1911 until his retirement in 1932, died February 15 in Beaumont, Tex. A native of Ireland, Marshall went to Beaumont to organize Burt Oil Co., predecessor of Magnolia, and he was its first secretary and treasurer. He was one of the organizers of Gulf National Bank of Beaumont, now First National Bank of Beaumont.

John W. Hestwood, 59, cashier of British American Oil Producing Co., Tulsa, fell to his death from a seventh-floor window of a hotel in that city February 15. He had been in ill health.

Charles F. Mason, president of C. F. Mason Oil Co., said to be the oldest oil company in Pennsylvania, died recently at his home in Pittsburgh. He was a member of Pennsylvania Grade Crude Oil Association. As a young man he was a star player on the old Duquesne University football team.

Dr. Frederick G. Clapp, 64, Bronxville, N. Y., internationally known geologist and consultant to several foreign governments, died February 18 of spinal meningitis in Chickasha, Okla., where he had gone to inspect oil properties in which he was interested. Clapp made the first maps of the Cement and Cox City oil fields in Oklahoma. From 1911 to 1915 he was petroleum and natural-gas expert for the Canadian Department of Mines and later was instructor in geology at Massachusetts Institute of Technology.

Clarence J. Shortess, 70, vice president and general manager of Colorado-Wyoming Gas Co., Denver, Colo., died recently of a heart attack at the home of a daughter in Wichita, Kans. He had been associated with Cities Service Oil Co. in Texas, Kansas, and Missouri 30 years.

Harry E. Brown, 53, a driller for Standard Oil Field Supply Co., died recently in Houston, Tex.

Ernest J. Renaud, 48, secretary and treasurer of Westexas Oil & Royalty Co., Fort Worth, Tex., died February 18. He moved to Fort Worth in 1929 from Abilene, and had been connected with Westexas since its formation.

Ernest P. Thomas, 66, employed in the maintenance department of Humble Oil & Refining Co., died recently in Houston, Tex.

Joseph A. Gaiser, 55, for the past 13 years an accountant for Stanolind Oil & Gas Co., Tulsa, died of a heart attack February 18. For 12 years previous to the merger of Midwest Refining Co. with Stanolind, he was employed by Midwest Refining Co. in Denver, Colo., and Casper, Wyo.

Shell-Developed Cumene Process Has Speeded Aircraft-Fuel Program

by John P. O'Donnell

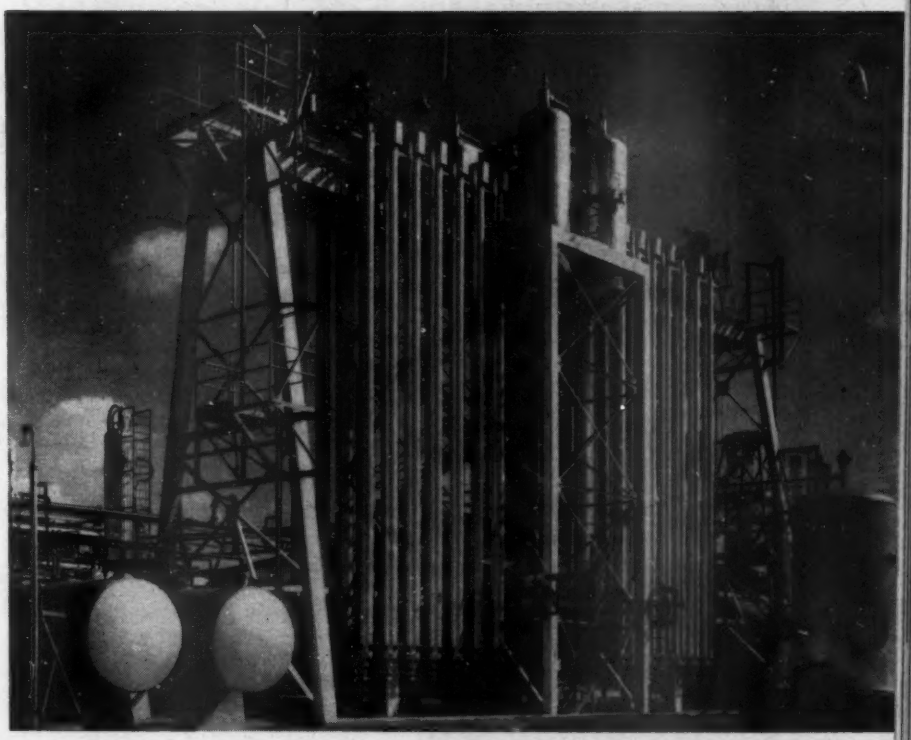
Nineteen units were producing cumene, blending component extraordinary for aviation fuels, as of January 1, 1944, employing a process the development of which started immediately after PAW approved the project. The first unit at Norco, La., was making cumene within 3 weeks after the plan was approved by PAW and WPB.

ONE of the most important steps taken by the oil industry to expand the limited supply of combat aircraft fuel in the early days of United States participation in the war was the development and widespread adoption of a process to produce cumene.

As soon as the use of cumene in aviation gasoline was approved by the military services and PAW, Shell Oil Co., Inc. technologists began the investigation of the possibilities of converting existing equipment. Preliminary calculations were made for the conversion of a unit at the company's Norco refinery and, within 3 weeks after PAW and WPB approval was obtained, this unit was producing cumene of high purity. In June 1942 a second unit at Shell's Wood River refinery had also been converted. Shell made the "know how" available to the industry, and today - 19 plants, most of which have been in operation in this service for more than a year, have been converted and are now producing a significant volume of cumene.

Cumene is a "high antiknock, aromatic blending agent used to improve the rich-mixture characteristics of superfuel." This definition describes its function as an aircraft-fuel blending agent but in no way indicates its very great importance, at the time, through the development of a readily adaptable process for its manufacture. This fact enabled an almost immediate increase in the quantity and quality of aviation fuel. This was particularly important since there was need for a fuel with better rich-mixture characteristics and to have obtained it otherwise would have resulted in a reduction in volume. Cumene was produced commercially for the first time on May 5, 1942, at the Norco, La., refinery of Shell Oil Co., Inc., using a process perfected by Shell Development Co. It was produced in an existing unit that required only minor modification.

At that time the ultimate 100-octane requirements of the United States and its Allies were only beginning to be appreciated. Even then the indicated demand was well beyond the limits of producitive capacity. It was im-



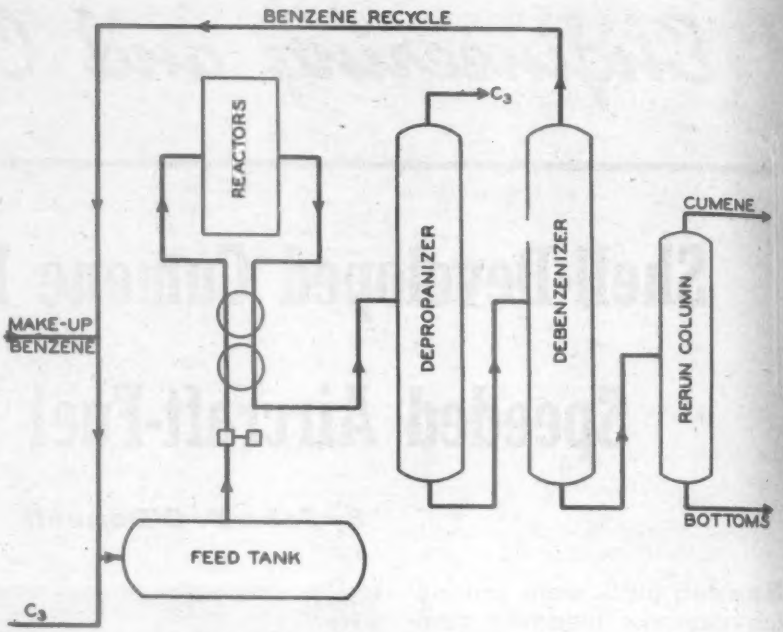
Unit at Norco, La., refinery of Shell Oil Co., Inc., the first to be converted to the manufacture of cumene. It went on stream May 5, 1942

perative to resort to every expedient possible for the expansion of this capacity. These expedients included increasing the amount of tetraethyl lead in aviation gasoline, conversion of existing equipment to the manufacture of components, erection of new equipment, elimination of bottlenecks, expansion of the production of codimer and the adoption of a process for the production of a hitherto unavailable blending agent — cumene. Of all the steps taken, the last was among the most important.

Importance of Cumene

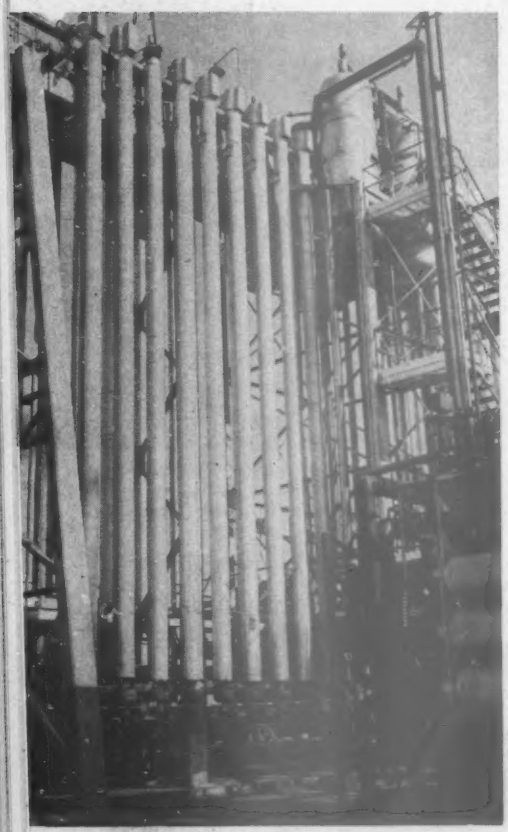
The immediate importance of cumene is apparent from the fact that the use of each barrel of this product as a blending agent permitted the use of several barrels more of straightrun base stock. Therefore the production of aircraft fuel was increased not only by the amount of cumene that was produced but this increase was expanded several times by the inclusion of the lower value material.

With 4 months after the first cumene unit went on stream, United States production had risen to 6,000 bbl. per day. Later other existing suitable plants were converted to its production and, as of January 1, 1944, 17 in the United States and 2 in Canada were using the Shell process to produce this highly desirable blending agent.



Flow diagram of cumene alkylation process

Closeup of catalyst tube bank in existing Norco unit which was converted to cumene production



During the early days of its use, information on cumene was closely restricted due to its critical position. Since then the coming on stream of additional catalytic-cracking units, which produce a base stock high in aromatics, has lessened its importance. However, it is still being used to the full extent of production capacity.

The value of aromatics such as benzene and toluene in gasoline was recognized long before this war. In World War I benzol-blend gasoline was found to be the most satisfactory aviation fuel then available. Since then benzol has been used widely as a blending agent. Prior to the commercial production of cumene in this war, benzene was used 5 per cent by volume up to the limit of its freezing point, in paraffinic blends. Early in this war the Germans, with aromatics available from coal processing, used them in their aviation gasoline.

Cumene is both a high antiknock and a rich-mixture additive for aviation gasoline. Its antiknock value, by the A.S.T.M. Motor Method, is 99.3. The power output value of cumene, which is reported to have slightly better aviation-fuel characteristics than toluene, may be appreciated from a comparison made by Klein in an S.A.E. paper. A 92-octane paraffinic fuel was given a power output value of 100. In comparison, a blend consisting of toluene, benzol and isopentane with 3 cc. TEL had a rating of 243.

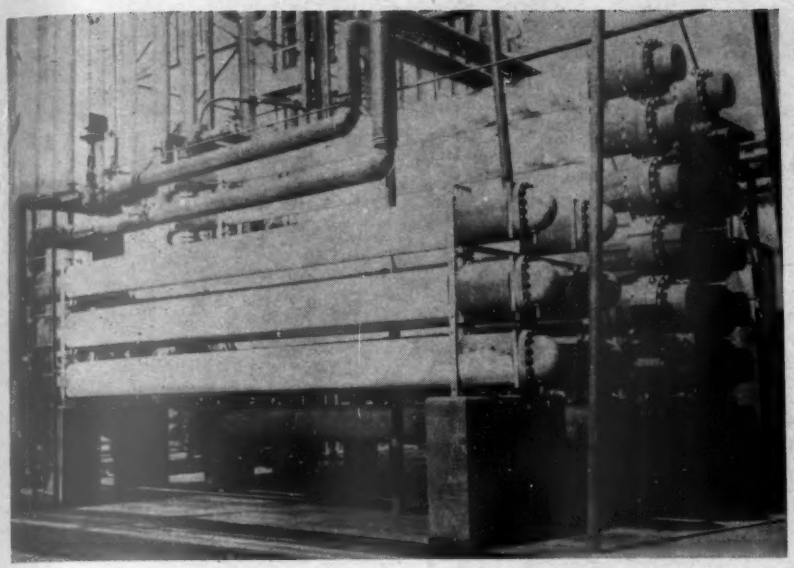
Another desirable quality of cumene is its blending value. Aromatics generally have superior octane blending values and cumene, with a blending value of 124 (A.S.T.M. Motor Method) rates well above the more commonly known aromatics, benzene and toluene. This quality is, obviously, one of the most important in evaluating aviation-fuel blending agents.

Factors in Cumene Preference

Other factors entered into the selection of cumene in preference to benzene or toluene as a blending agent with improved power-output rating. Use of benzene was limited by the fact that it has a relatively high freezing point, 5.5° C., and therefore it was unsuitable for use in high concentrations in high-altitude flying. Also important is the fact that cumene increases the volume substantially over benzene and also results in better antiknock quality. It also has a higher B.t.u. value per pound but it has a disadvantage in its higher boiling point. Toluene, the second member of the aromatic series, was already in great demand as a component of trinitrotoluene.

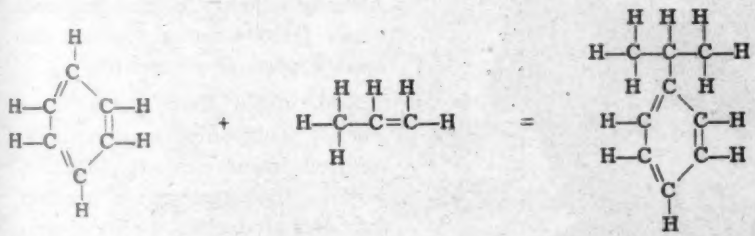
Besides having a sufficiently low freezing point and a high value as an aviation-gasoline component, cumene possesses another advantage. It is a product of the alkylation of benzene and propylene. While propylene has high octane and octane-blending values, its vapor pressure is too high to permit its inclusion as such in aviation gasoline. Therefore the production of cumene, or isopropylbenzene, brought another hydrocarbon into the aviation-gasoline picture and, by the addition of this material, enabled a corresponding increase in aircraft-fuel production.

Laboratory synthesis of alkyl-sub-



Product-to-feed heat exchangers and hot-oil feed preheaters on first commercial cumene unit at Norco

stituted aromatics of which cumene is a member has been known for some time. The Freidel-Crafts synthesis using aluminum chloride as a catalyst is treated in all organic-chemistry text books. The synthesis of isopropylbenzene was discussed by Berry and Reid almost 20 years ago. This reaction may be pictured as follows:



C_6H_6 Benzene + C_3H_6 Propylene = $C_6H_5—C_3H_7$ Isopropylbenzene or Cumene

The raw materials for the production of cumene were available in sufficient quantities to produce an appreciable volume. Benzene is obtained chiefly in the coking of coal while propylene is available in the gaseous byproducts of thermal cracking. The C_3 fraction from conventional thermal cracking, such as that practised in the Dubbs process, contains approximately 30 per cent propylene and 70 per cent propane.

Problem Complicated

While the synthesis was recognized and raw materials were available in quantity, the practical problem of the development of a process that would use the available propane-propylene fraction as an olefin source and which would operate continuously or with a minimum of downtime for catalyst replacement still remained. This problem was further complicated by restrictions on construction which emphasized the use of existing equipment to the maximum extent.

Shell Development Co. undertook experiments leading to the development of a process adaptable to already-built units employing a commonly used catalyst. A comprehensive study of operating conditions such as temperature, benzene-propylene ratio, etc., led to the development of a process for which the large number of existing units in this country were suitable after minor modification. This included, principally, installation of additional fractionation capacity for the separation of benzene, additional heat-exchanger surface required by the higher temperatures involved and some piping.

At Shell's Norco refinery, makeup and recycle benzene and the C_3 fraction from the stabilizer are accumulated in a surge tank. The combined feed is pumped to the reactors, picking up necessary heat in exchange with the products of the exothermic reaction. Products of the reaction are then depropanized and then debenzenized. The benzene thus recovered is recycled to constitute a portion of the feed to the reactors. Bottoms from the debenzenizer are further fractionated in a column which produces finished cumene as an overhead product.

Vibrator Devised From Riveting Hammer

A VERY useful and rugged vibrator, either portable or fixed, may be made simply as described below and as shown in the photograph. Such a setup is useful in handling dry or spent filter clay, catalyst or any other pulverized material which must be handled rapidly, as through a funnel-shaped vessel, to prevent caking and piling up within the vessel.

A conventional riveting hammer (air) has a section of 2½-in. pipe fitted over it as a cylinder. This cylinder is threaded and screwed then welded into a base of flat steel ½ in. thick or more. The base extends beyond the cylinder on opposite sides, and these extensions are drilled with suitable holes for bolting down the assembly. The plunger of the air hammer rests on the base inside the cylinder, and a small hole is drilled immediately beneath the plunger in the base, to permit exit of dirt, etc., which might get into the assembly. Drilled lugs are arranged on each side of the top of the cylinder. A ⅜-in. strap is bent over the hammer top, one stop lug on each side, to prevent its slipping off, and the strap is bolted to the drilled lugs at each end. Coil springs are fitted on these bolts holding down the tie strap, to give a certain small flexibility to the assembly and lessen the jar on the hammer and its fittings. By means of the two drilled extensions on the base this assembly may be bolted temporarily or permanently to any desired equipment.

— then he said to himself

"TIME DOES NOT WAIT"

"THE foe cannot be beaten," says Joseph Stalin, "if his forces of today, fully developed to the utmost, are opposed by forces of tomorrow . . . TIME DOES NOT WAIT."

So, by having recourse to the forces of tomorrow TODAY . . . he makes NEWS . . . he achieves TRIUMPHS . . . he dictates HISTORY.

"Developing tomorrow's force TODAY" can well be the motto hanging in every conference room where factory committees are discussing postwar procedures.

And under that motto these words: "Our ship, tank, plane, weapon industries are TODAY working with tomorrow's greatest forces for production. Come re-conversion to peacetime products, they are in practiced strategy to outproduce and underprice all competitors who have the temerity to go into post-war production with day-before-yesterday's techniques."

"Even if you had the time—don't wait for time."

"TIME DOES NOT WAIT"... *he says*

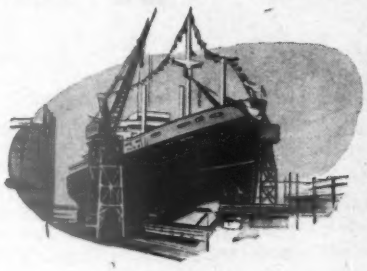
Look, Mr. Stalin, how through *recourse to Arc Welding* you can tweak time's forelock.

Similar time savings gave you tomorrow's force today.

Arc Welding, of course, will not win the war for you . . . but lack of Arc Welding could have lost it for you.

And that thought might well be another motto for each postwar planning room.

DAYS instead of MONTHS



Easily the margin between Victory and defeat—for you and the United Nations—is putting ships on the water *6 times faster.*

LAST WAR "Liberty" size ship 300 DAYS
THIS WAR they average under 50 DAYS

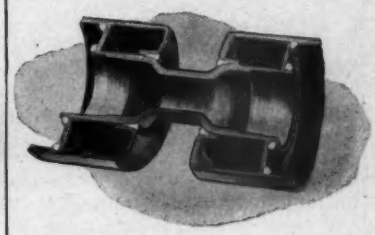
Recourse to Arc Welding in 2 years has put to work 2000 more ships than possible under old standards—thus saving the necks that Old Methods would have lost—yours and ours.

Think *that* one over!

HOURS instead of WEEKS

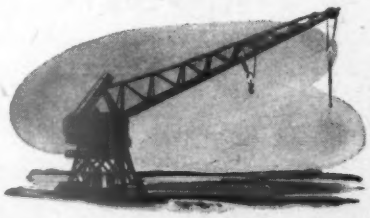
A sit-down in a steel plant lasting for weeks would be a headline SCREAM in Pravda and every newspaper in the world. That catastrophe was averted by *recourse* to Arc Welding when these six welders repaired the break of a vital steel mill part in 8 hours. Replacement would have taken weeks . . . thus sabotaging the output of a hundred war producers. Think that one over too—in terms of providing *recourse* to help in trouble.

MINUTES instead of HOURS



Half-track parts at half-time speed . . . these are typical of machine parts which *recourse* to Arc Welding helped rush to first and second fronts. Processing cost cut from $11.00 to $6.64. Machining cost cut from $3.50 to $1.25. Weight cut from 27½ to 24 lbs. Time cut 45%. This cutaway picture is to help you think over what *recourse* to Arc Welding will do to the cost of any part of any of your machines.

MINUTE-MEN of production cut MAN-HOURS on every job



This 28-ton revolving crane which literally gives the *lift* to America's ultra-speedy shipbuilding industry—gets to the job 1,584 MAN-HOURS SOONER through *recourse* to Arc Welding.

FABRICATED . . . 23.5% FASTER
ERECTED . . . . . 21% QUICKER
than by riveted construction.

THE LINCOLN ELECTRIC COMPANY • Cleveland 1, Ohio

America's greatest natural **recourse**

ARC WELDING

Pressure Maintenance by Conjoint Injection of Gas and Water —A Wartime Suggestion

*by Frederick Squires**

Recommendations of the author in this article are based on long study of the effects of water and gas injection upon reservoir behavior and oil recoveries. It is shown that the return of both water and gas to a reservoir under hydrostatic control in a joint operation serves a definite function in maintaining or restoring original pressure conditions and relationships.

LITTLE was known of petroleum engineering when the first World War began. H. L. Doherty had not yet discovered that oil when saturated with gas develops a greater fluidity. The need for retaining the original reservoir pressure of an oil pool was not yet appreciated, and the necessity for its corollary, pool unification, had not been sensed. Repressuring with gas and air had only begun. J. O. Lewis had not yet stated his concept of restoring high pressure to oil sands by the injection of gas in order to produce oil from tight sections as well as from open sections of the stratum. Paul D. Torrey had not yet applied Lewis' idea to water flooding by devising his delayed-drilling technique. Water flooding itself was usually done by line flood, which was but a short step in advance of Carll's ancient advice of returning water to a reservoir in the amount of the fluids removed.

A German artillery officer was using the reflection seismograph to locate enemy big guns by earth vibrations caused by their discharge, but the idea had not yet been applied to discovery of oil structures. Electric well logging was unknown. Drilling was generally a cable-tool job although the rotary method had been known since its use at Spindletop. The laboratory was barely on speaking terms with the oil field, and such refinements as core analysis had not yet appeared. Dr. Merriam was perfecting his absorption gasoline-extraction process but most others were content to use compression and refrigeration. Chemical developments such as acidizing were not in practical use.

Knowledge Gained Between the Wars

Between the wars there was a great advance in comprehension of oil-reservoir conditions. It was realized that many strata containing oil reservoirs slope downward from the surface, that they are under water pressure, and that the measure of the pressure on the oil trap is closely related to the degree of pressure which would be exerted by a continuous body of water extending through the strata from surface to reservoir. From this observation it was deduced that the pressure on the reservoir is hydrostatic. Gas was found to be in solution in the oil in an amount corresponding to that which would be absorbed at the degree of pressure and temperature existing in the reservoir. This dissolved gas reduces the viscosity of the oil. Such a reservoir is in ideal condition for oil production.

When a well is drilled into an oil sand which is under water pressure, and which is fully saturated with oil that contains gas in solution the pressure differential between the reservoir and the surface forces oil up and out of the well. The gas comes out of solution in the well bore as the pressure on the flowing oil is reduced proportionally to its depth below the surface. As the oil and gas move out, edge water moves into the pool in an effort to restore equilibrium, and if it were not for the retarding action of friction in the sand, the reservoir fluids would move through the reservoir like water through a bent tube. How fast the pressure in the reservoir falls when wells are allowed to flow wide open depends on the degree of pressure at the water-oil contact in the reservoir, the distance to be traveled, and the permeability of the sand. With few exceptions this permeability is not high enough to permit sufficient additions from edge water to compensate for the vented oil and gas. So the pressure declines in all directions toward the well. With sufficient decline, gas comes out of solution from oil at constantly increasing distances back from the well, and the viscosity of the gas-freed oil increases. If the permeability is low there will be a lag in water encroachment that will result in diminishing pressure and increasing viscosity from the water at the water-oil contact to the well itself. Gas comes out of solu-

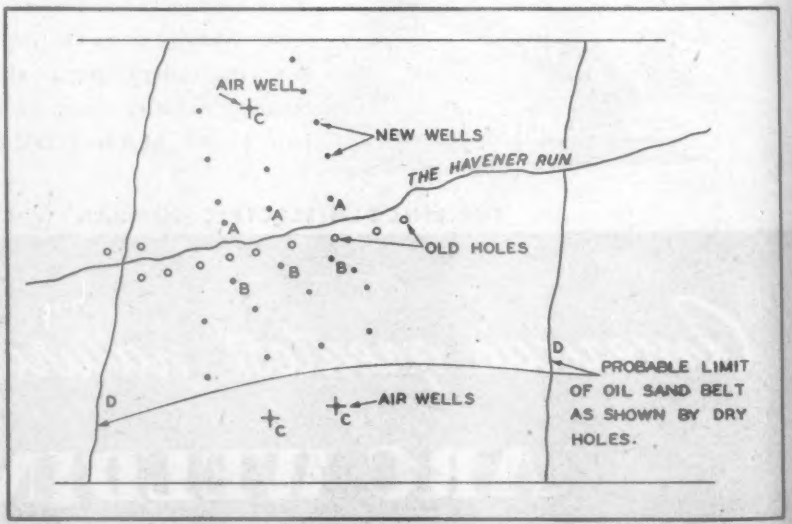


Fig. 1

*Petroleum engineer, Illinois State Geological Survey. Published by permission of the chief, Illinois State Geological Survey.

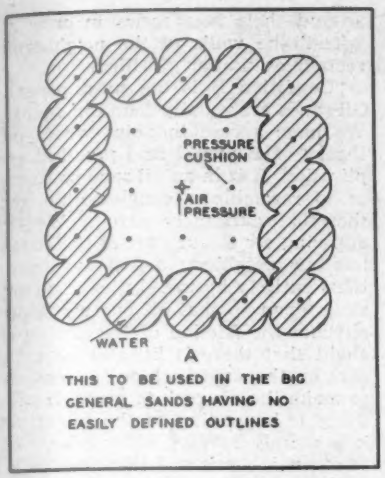


Fig. 2

tion over widening areas, flowing stops, and pumping will have to begin. Under such conditions it is no longer possible to extract oil efficiently, yet this condition always arose, due to the customary production practices in oil pools before the first World War.

The Problem

The writer began to investigate the conjoint use of gaseous and liquid media to increase pressures on oil sands in an effort to correct some of the evils of the condition just stated and thus to increase production. His earliest conception of the conjoint use of gas and water injection to increase yields from oil sands is best illustrated by the following letter written in Marietta, Ohio, December 15, 1915:

"The following is a description of my 'flood-air pressure' system of obtaining oil and gas from porous strata.

"At one part of the Buck Run belt the over burden on the oil-bearing stratum was partly cut through by the Havener Run, and into the shallow covering above the sand innumerable wells were 'kicked down' in the old times and after being abandoned were left open. During certain seasons of the year the river overflows its banks and backs up the Havener Run so that these old holes let immense quantities of water into the porous sandstone. Leases on and near Havener Run are shown in Fig. 1.

"I noticed nothing unusual about this except that new wells drilled at AAA BBB near the run made nothing but fresh water. We applied air pressure at CCC and almost immediately all the new pumping wells increased their production of oil much faster than any of the several hundred wells at a distance from the run. Also different pressures could be maintained on different sides of Havener Run. From these facts I deduced that the oil between the edges of the sand

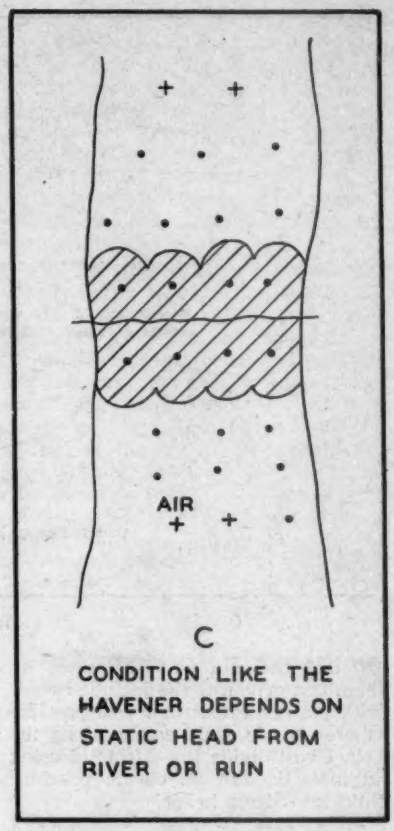


Fig. 4

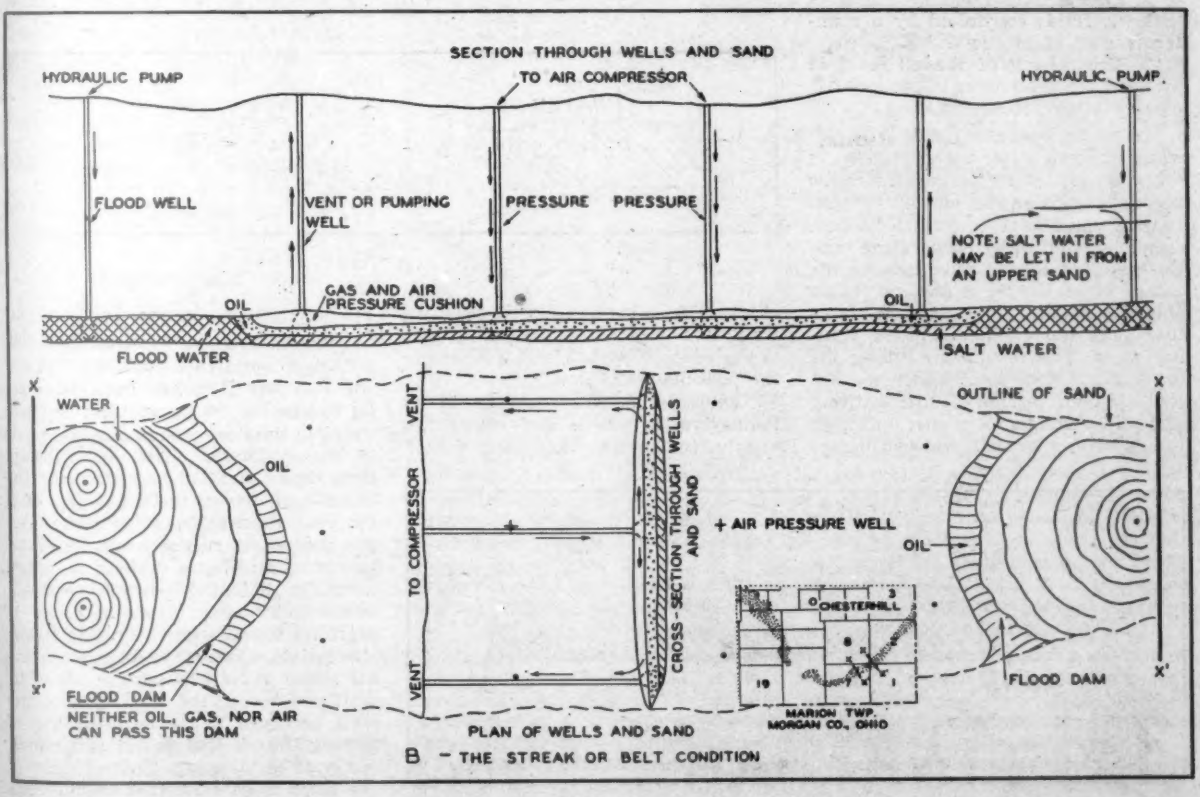


Fig. 3

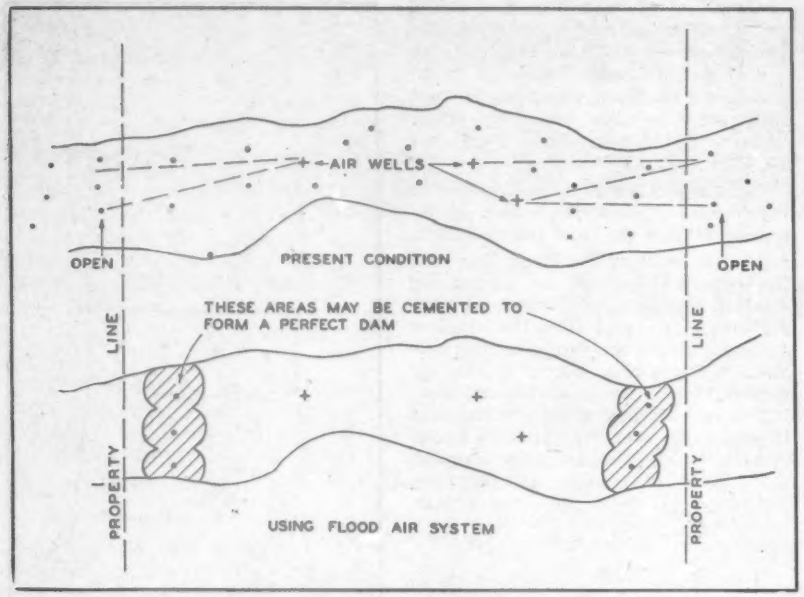


Fig. 5

around their boundaries in order to 'offset' the wells of the neighboring rectangles similarly drilled.

"Condition B is the most general. Oil sands are usually found in streaks. We have a case in point where the theory of B would find practical application. It is in an oil sand so coarse as to resemble a conglomerate and therefore extremely porous. We are applying air to our part of the streak but our neighbors defeat our intentions entirely by merely leaving their wells open so that all our air passes out and the friction of the sand is so slight that there is little or no pressure on the sand such as is necessary to make the air rush to vents. If anything is happening to the oil at all, it is merely moving off our lease on to our neighbor's and there can be no doubt that the gas is doing this (Fig. 5).

"Condition C would be used where the supply of water was from a river or some similar source which would have enough head above the sand so that it could be depended on to keep

DD and the run was entrapped by them and driven to the included wells with greater force than was possible where the air could escape along the belt. I will divide the effects of using an inelastic and an elastic pressure fluid into three heads.

"1. A dam or dams including a pressure cushion.

"2. Encroaching flood or floods of inelastic fluids controlled by a counterpressure of elastic fluids.

"3. The raising of the oil level in the sand between dams to prevent bypassing of the elastic fluid.

"In (1) the operator floods with salt water or fresh water under high static pressure or by means of hydraulic pumps a portion of an oil or gas-bearing sand so as to form a barrier, either by itself or by cooperating with the edges of the oil-sand belt, to the escape of (a) the oil or gas and (b) an elastic pressure fluid used to force the oil or gas to the included venting wells. The results are these: the oil or gas can be kept under the operator's own territory until entirely removed through his wells; and high pressures and small losses can be achieved by using the elastic pressure fluid that will carry the oil or gas to the vents. Figs. 2, 3, and 4 illustrate the possible conditions.

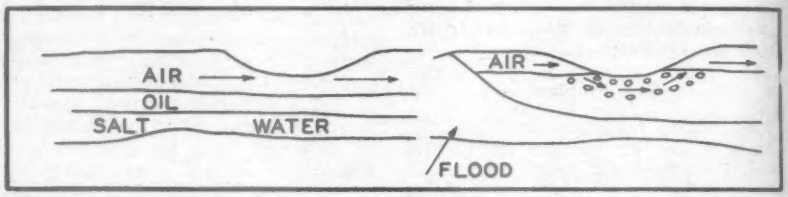


Fig. 7

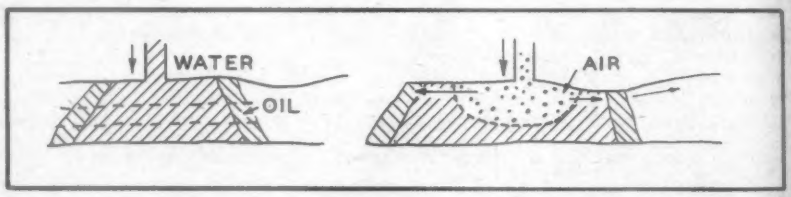


Fig. 8

"Condition A has been found in Pennsylvania where the leases are mostly rectangular and are drilled

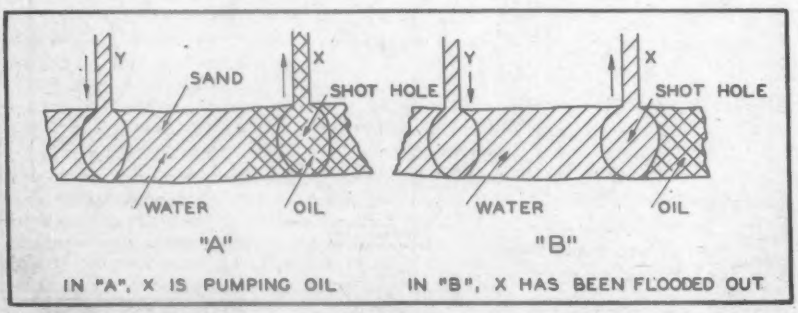


Fig. 6

the dam tight against the air pressure.

"Encroaching floods of surface water on oil sands are no invention, for the Havener Run has been flooding its sands for 50 years, and surface water in the deep and noncaving wells in Pennsylvania (1,600 ft. through rock and shale) have flooded the sands and driven the oil ahead of it for years under 800-lb. pressure. But the control of encroaching water by means of an elastic cushion is brand new. The difficulty heretofore experienced in flooding sands in order to drive oil to wells has been due to the short time allowed to pump off the oil while it was passing under the well and before the water got to the well, and also to the impossibility of getting the oil that is not carried directly to an opening. The advance of the flood is so slow that the gas has time to escape before it through the

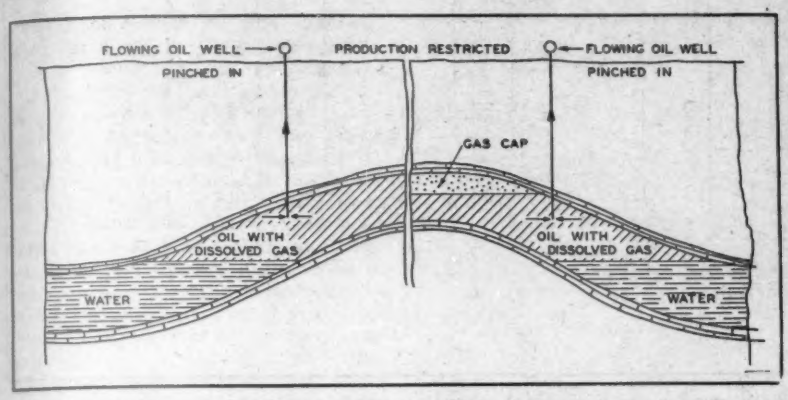


Fig. 9: Pressure maintenance by restriction of oil and gas production

Fig. 9 illustrates a section through an oil reservoir, showing the relations of gas, oil, and water, and wells to the oil production. On the right is shown a gas cap with oil below and water at the bottom. In each case the amount flowing from the well is regulated to retard as much as possible the pressure drop caused by unloading the reservoir. In it an attempt is made to balance oil and gas withdrawal to the influx of edgewater. The difficulty encountered is that when oil and gas are withdrawn, the water encroachment forces oil into the abandoned part of the gas cap, and such oil can never be recovered from the sand

wells, and there is nothing but friction to retard the flood, since no gas pressures have been set up. The oil and water do not mix, the oil being driven before the water as in Fig. 6—in A well X is pumping oil, in B well X has been flooded out. In my method when the encroaching flood has brought the oil to well X, the air pressure is increased so as to check the flood and give time for the oil to be pumped or flowed off. This is exactly what is being done now at Havener Run. Wells are pumping oil which, had it not been for the counterpressure of the air on the flood, would have been drowned out with water from the run. The reverse of this is often seen in fields after they have been drilled. The wells let off the gas pressure which has been retarding the natural flood of salt water, and when this pressure is released the water rushes in and drowns out the wells, that is, makes them pump nothing but salt water, the oil being forced to another part of the sand and often never found by the drill.

"The process under (2) would be to drive oil or gas by the advance of a liquid under pressure until it reached venting wells, and then to reduce the liquid pressure and to increase the elastic counterpressure until time enough had elapsed to remove the oil. Then the advance of the liquid would be continued until another favorable point was reached. (Note that flooding sands with fresh water is unlawful in one or two states but there is no law against using salt water which is found in the sands themselves.)

"It often happens that after air pressures have been used for some time the upper parts of the sand become quite cleared of oil and the air 'blows' through from the pressure well to the venting well without moving the oil at all. Methods have been devised for lowering the casing in the venting wells so that it extends almost to the bottom of the sand in order to insure the pressure air traversing the fluid. An incidental advantage of flood air is that the encroachment of the flood raises the fluid level (oil and water) and in cases of inequality in the roof of the sand the oil may cut off the air passage entirely and so cause the air to strike directly on the oil (Fig. 7). Alternating air and water pressures into the same well will accomplish the same result through a limited space."

The method illustrated in Fig. 3 was put into operation on the Howard farm in 1916.

The disclosures related in the letter of December 15, 1915, resulted in the U. S. Patent No. 1198078, granted September 12, 1916, the first claim of which reads, "the method of recovering oil and gas which consists in forming a liquid dam under pressure in the oil-bearing sand to prevent the escape of the entrapped oil and gas and applying pressure independent of the liquid to said oil and gas to vent them."

Combination of Idea of Conjoint Injection With Present-Day Knowledge of Reservoir Behavior

Water under static head is the prime mover in producing oil and gas from most oil-field reservoirs. It makes gas a secondary mover by compressing it and keeping it in solution in the oil. The combination of energy from hydrostatic head and fluidity from dissolved gas provides the ideal motive power for venting oil as long as the

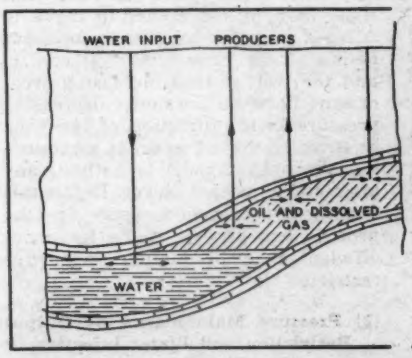


Fig. 10: Pressure maintenance by water injection and restriction of oil and gas production

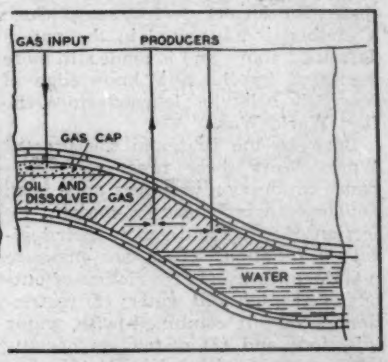


Fig. 11: Pressure maintenance by gas injection and restriction of oil and gas production

Fig. 10 illustrates a section through half an oil field on an anticlinal closure in which oil with its dissolved gas occupies the higher part and water under pressure occupies the lower part. Pressure maintenance to overcome the drop due to withdrawal through the producing wells and the lag due to friction encountered in the movement of oil and water through the sand is accomplished by injecting water from the surface into the water in the structure. The success of this practice usually depends on a restriction of withdrawal of oil and gas from the producing wells because it is difficult to balance input with output under conditions of open flow. All gas withdrawn is lost to the reservoir.

The application of this method is best illustrated in the East Texas pool

Fig. 11 is a simplified diagrammatic illustration of the process of injecting gas into an anticlinal structure in order to increase ultimate production of oil. Gas is injected into an existing gas cap. If no gas cap were present, the top of the structure would be occupied by oil saturated with dissolved gas, and the pressure-making gas would be discharged with the oil. The procedure is usually combined with restrictions on oil withdrawals in order to prevent rapid increase in gas-oil ratios. Edgewater encroachment cannot make up for the void caused by the removal of oil. The process is well illustrated at Louden, Illinois

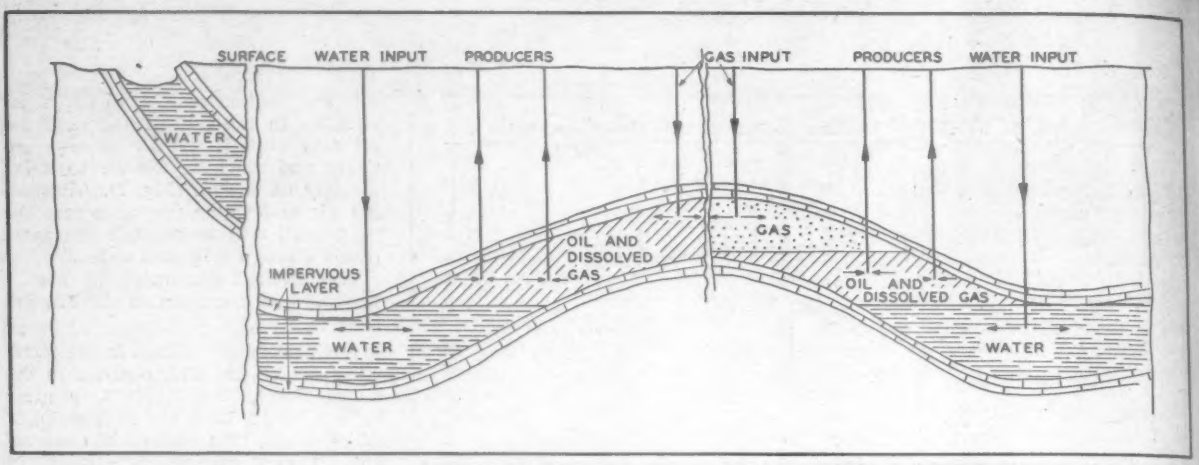


Fig. 12: Pressure maintenance by conjoint use of gas and water to maintain reservoir pressure

***Fig. 12** is intended to illustrate the similarity between the potentialities of an anticlinal structure containing gas, oil, and water in its virgin condition and one in a condition restored by injecting gas and water at appropriate points. It is believed that the pressure existing in a virgin pool is produced by the static head of water entering the stratum at the surface. This is shown on the left side of the diagram. Gas and oil are forced to the high part of the trap. If the pressure is beyond the critical point, gas is absorbed by the oil until all the gas is taken up or until the oil is saturated. Any additional gas, having nowhere else to go, accumulates above the oil in a gas cap. Wells marked "producers" vent oil and dissolved gas, and the water moves in an effort to restore equilibrium, which effort is partially defeated by the retarding effect of friction with the sand. Injection of water and gas are depended on to restore original conditions*

reservoir retains sufficient pressure, but abruptly ceases to work when the pressure is lowered below a critical point. Because the reservoir is in its ideal condition to vent oil when under original pressure and is ineffective as soon as the pressure is sufficiently lowered, the logical procedure must be to bring it back to its original ideal state by injecting the same elements, water and gas, which produced the former perfect setup. Such a method is advocated in the patent described above and is made still more pertinent by the new knowledge of reservoir behavior learned since the first World War.

Between the first and the present World Wars three pressure-maintenance production practices have been developed which lead to conjoint injection of water and gas as their logical culmination. These are pressure maintenance by (1) restriction of output of gas, oil, and water; (2) restriction of output combined with water injection; and (3) restriction of output combined with injection of gas.

(1) Pressure Maintenance by Restriction of Output (or Retarding of Pressure Drop) (See Fig. 9)

This procedure would be more efficient were there no obstacle to the free flow of the fluids from the edge water through the sand, to and out of the well. It is less efficient with greater distances or with lesser permeabilities in the strata through which the fluids must pass. Almost never is the permeability of the sand in a field of average size so high that water can flow in from the edge as fast as oil and gas flow out through wide-open flowing wells. In order to maintain as nearly as possible the original reservoir pressure, it is now common practice to pinch in the flowing wells in an effort to conserve the pressure by balancing the output of the wells with the advance of edge water. This is seldom possible, the best result obtainable in practice being a slowing down of the rate of pressure loss.

Gradually the pressures fall to points at which gas is released from solution in the oil, farther and farther back from the well, increasing the viscosity of the oil at the very time that there is less power to move it. A lag is set up between the propulsive action at the edge water oil contact and the well so that increasing areas of sand between are under decreasing pressure in the direction of the well. Eventually the oil in areas surrounding the output wells is without any appreciable motive power. Before this condition is reached, however, the process has proved to be far more efficient than production under unrestricted flow.

(2) Pressure Maintenance by Output Restriction and Water Injection (See Figs. 10 and 13)

Pressure maintenance by injection of water into the inward moving edge water surrounding or adjoining an oil pool and a restriction of oil production to equal the volumes of encroaching water, as is being done in East Texas, is now an approved production practice.

Carll recommended it in the early days of oil production. It is a principle suggested by natural water encroachment and borrowed from line-drive flooding. The present-day need for underground disposal of large quantities of salt water that is pumped from other oil-producing horizons gives a new supply of flooding fluid and a new reason for water injection. In theory, the water around the pool must be constricted by its own inflow and by injection of water from the surface or upper sands to such an extent that the oil and gas within the reservoir remain constantly under the original pressure. But, in practice, whenever the distances are great and the sands are of low permeability, pressures are bound to decrease toward the center of the pool to such an extent that part of the oil gives up its gas from solution, with a consequent loss in motive power which partly defeats the purpose of the method. Also, since only water is injected, all gas not used for fuel is wasted. Where the sands are highly permeable, as in the East Texas field, the augmented water pressure may keep the whole body of oil under sufficient pressure to hold the gas in solution until it flows with the oil from the wells. Degree of permeability and amount of pressure is the measure of efficiency of this production method.

Oil production must also be restricted except in pools with sand of such high permeability and under such high water pressure that the injected and encroaching water follows up the removal of oil to the point that the sand is kept completely saturated above the critical pressure throughout the entire life of the wells. Such a condition seldom exists because the permeability of a sand body is never uniformly high and this is a requisite for completely successful results. In general, however, this production method, as best illustrated in East Texas, is an important improvement.

(3) Pressure Maintenance by Output Restriction and Gas Injection (See Fig. 11)

This phase of pressure maintenance

is the practice of injecting gas into an existing gas cap overlying gas-saturated oil or into the gas-saturated oil itself. Where water under pressure is present around and below the oil and there is a gas cap above it, increased or maintained pressures on the gas cap keep the underlying water from raising oil into the gas sand from which it cannot be recovered. Gas pumped into the gas cap or pumped in to form a gas cap of its own, vents oil on the same principle as the seltzer bottle. Later comes the process of venting oil by the movement of gas through the sand. The movement of gas from input to output wells increases production by absorbing and carrying along with it the lighter constituents of the oil and by blowing oil to the wells in the direction of gas travel.

A considerable part of the gas produced is not available for return to the formation because it requires prohibitive amounts of machinery, because part of the gas must be used for fuel, and because its heavy vapors are commonly removed in gasoline plants. Consequently, there is never enough gas returned to make up for oil and gas withdrawals so that the reservoir pressure is gradually reduced. Even if gas were returned in sufficient amount to compensate for the water, oil, and gas taken out, the slow rate of absorption of gas in oil would cause expansion of the gas cap and increased gas-oil ratios. Natural edge-water encroachment is seldom fast enough to make an appreciable reduction in the amount of gas required. The problem is usually solved by reducing the withdrawal of the oil and water to the point at which it does not lower the reservoir pressure. This takes more time to deplete the pool, and time costs money.

The efficiency of the method of pressure maintenance by gas injection depends on the proportion of oil in the sand that can be vented by means of gas. This is usually much less than the proportion that can be vented by water. Also in practice, pressure maintenance by gas injection has a very short life span as compared to the producing life of the field, beyond which span it is impossible to maintain pressures high enough to keep original gas in solution without producing too high a gas-oil ratio. Because the amount of oil in the reservoir is constantly decreasing and a constant amount of gas is being pumped in, more and more gas stays out of solution and exists as free gas in caps resulting in an increasing gas-oil ratio. The process eventually changes into a repressuring operation. In many pools distances from edge water to edge water are so great that water encroachment has little influence. Pressure maintenance by gas injection is, however, a great improvement over primary methods of production as has been proved in the Louden pool in Illinois.

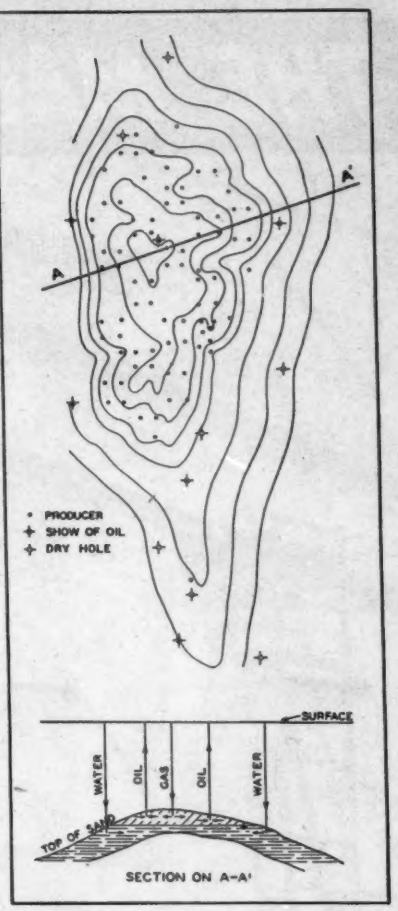


Fig. 13: Well density and contours showing structure

Fig. 13 shows by well locations, contours, and section, a picture of an Illinois oil pool, and illustrates the way conjoint injection of water and gas may be used to regain original reservoir energy. The section is diagramatic only. Wells shown on it do not repeat on contour drawing and vice versa. Such a pool is not too large in extent to be influenced all over by artificial means. Water from upper sands as well as from the oil-producing sand may be used, and the available volume of this water is practically limitless. Gas vented from the oil-producing formation may be augmented by air so that the availability of this pressure restoring medium also becomes unlimited

Pressure Maintenance by Conjoint Water and Gas Injection (See Fig. 12)

A reservoir that contains water under pressure around its lower perimeter, contacting a central oil body that is charged with gas in solution, either with or without a gas cap, is in the ideal condition for giving up its oil. When pierced by wells, the oil flows, and at no later time is so efficient a means for capturing oil provided. Since this is the ideal setup, the ideal solution for a continuance of similar results must be the provision of means for keeping the pool in its original condition. The logical procedure then must be the conjoint injection of gas and water, each forced into the stratum in the areas where each kind of fluid was originally found.

Such a method combines all the advantages of the restricted output, the gas injection, and the water-injection-maintenance methods just described. Conjoint injection has the added advantages of halving distances and doubling areas of pressure. The water boundary is contracted by adding enough water to keep the diminishing area of oil sand always completely saturated at the original pressure, and gas is returned in the amount currently liberated with the oil. Thus greater quantity of oil may be withdrawn without lowering pressures. The wells might be kept flowing for their entire life, and the quantity of oil and gas removed at all times might be held more nearly to the initial production of the wells. Since water can be injected in a wide circumference, great quantities can be used without causing a too-rapid invasion of the oil-filled center of the field, resulting in a duplication of natural encroachment with its well-known long production life.

Unitization

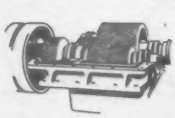
The physical elements involved in retaining the ideal conditions of a virgin field have been described. In order to carry out the method successfully, a field must be operated as a unit. However, when there is diverse ownership, unitization is often difficult to obtain.

Unitization should be easier to bring about now than it has been in the past for these good reasons: Its value is known, the inevitable shortage makes efficient extraction of oil imperative, and the war emergency appeals at the same time to enlightened self-interest and patriotic duty to produce for victory.

Acknowledgment

They used to say at college that the pitcher can be no better than his support. Such a statement is true of the petroleum engineer, and it is for this reason that the writer wishes to acknowledge with thanks the encouragement and direction of M. M. Leighton, chief of the Illinois Geological Survey; A. H. Bell, head of the Oil and Gas Division, and its other members, C. W. Carter, Carl A. Bays, Stuart Folk, William H. Easton, E. P. DuBois, Paul Luckhardt, Wayne Meents, and J. S. Yolton.

BUILDING THE MACHINES OF



Though we are still in production, on a "round-the-clock" 24-hour basis, producing *tank gears, ship gears, gun carriages,* and *truck-trailers* for our armed forces, we are also producing considerable quantities of Lufkin oil field pumping equipment.

WAR HAS VASTLY INCREASED LUFKIN'S *facilities and ability to* BUILD FOR PEACE

. . . increased capacity . . . finer and better precision production tools . . . new metals . . . new methods . . . men skilled and trained to the exacting requirements of the machines of war, will put *LUFKIN* in a most advantageous position to produce oil well pumping units for peacetime production.

Even now, while producing to the utmost for war, *LUFKIN* is still meeting the emergency requirements of its civilian customers and reconverting to civilian production as fast as the needs of war level off.

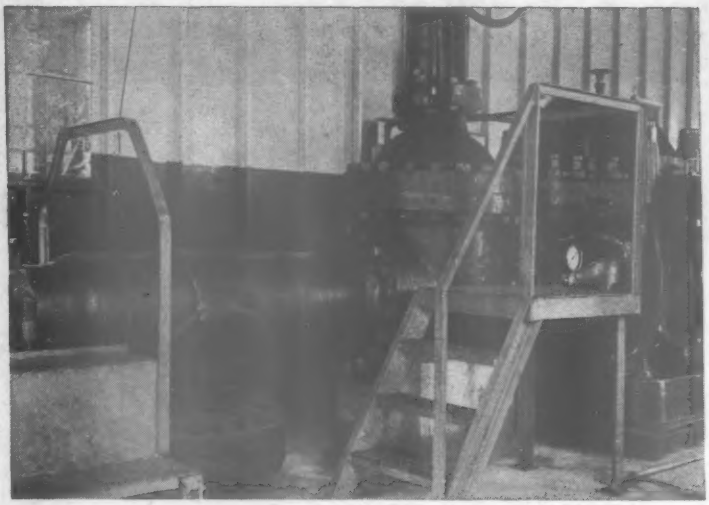
Consult our nearest office for a delivery program.

LUFKIN
PUMPING UNITS

ARMY ★ E NAVY

COMPANY • LUFKIN, TEXAS

PIPE-LINE SUGGESTIONS

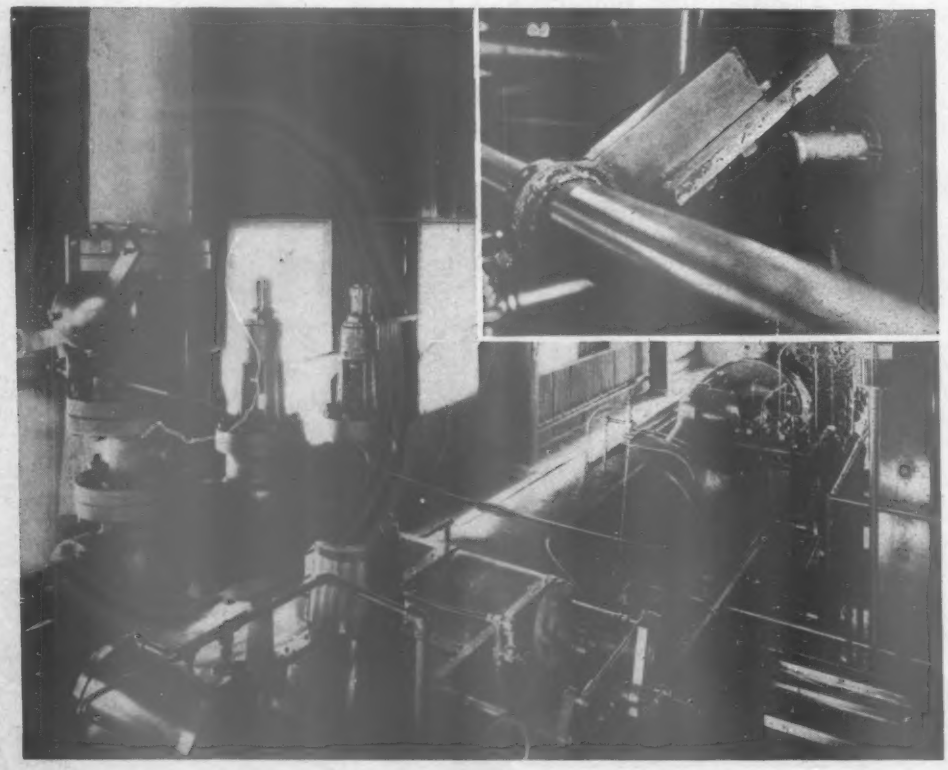


Platform for Manipulating Large Valves

SPECIAL platforms and stairways are built to aid operators to manipulate valves at the station of a large-diameter crude-oil line. At the left can be seen a stairway or stile which is convenient for crossing over the flexible coupling; the flexible coupling is accessible at all times.

Guard for Engine Exhaust

TO provide effective protection against injury from contact with the exhaust of a 400-hp. diesel engine, a guard has been installed, made of small steel rods 2 in. apart which are placed at a sufficient distance from the exhaust pipe to insure that employes will not be burned while manipulating valves or doing other work around the engine.



Throttle Control For Steam Pump Station

AT a steam pump station, an emergency overspeed governor shuts down the unit when speed increases to an excessive rate. A pin that is set radially in the flywheel is held in place by a spring which prevents it protruding beyond the rim at normal speeds. With overspeeding, centrifugal force pushes the pin out so that it contacts a trip, causing a shaft to turn, at the end of which there is a lever actuating a rod which closes a weighted lever valve, throttling the steam line. A turnbuckle in the rod may be adjusted by station engineers to attain correct length for functioning properly.

GASOLINE FROM SOUR CRUDES

raised AS MANY AS 12 octane numbers

by PERCO CATALYTIC DESULFURIZATION

Perco Catalytic Desulfurization has been proved the most effective process known for the handling of virgin aviation gasoline. Recent tests covering twenty-five gasoline samples from Texas, New Mexico and Oklahoma crudes, show an average leaded increase of 6.0. . . . *In some cases 11 and 12 increased octane numbers were recorded!*

Perco Catalytic Desulfurization provides essentially complete removal of the more harmful pro-knocking sulfur compounds. Almost invariably this economical process will step up the octane rating of products distilled from sour crude to permit the manufacture of highest quality aviation base stocks.

In addition this process has other attractive advantages:

1. **Simple to operate.**
2. **Catalyst cost per barrel is low.**
3. **Installation expense is reasonable.**
4. **Available equipment can be used in many cases.**

Perco Engineers can accurately estimate how much Perco Desulfurization will increase the value and usefulness of your sour gasoline . . . Wire or write.

PROCESSES ★ ENGINEERING
PERCO
RESEARCH ★ CONSTRUCTION

Division of

PHILLIPS PETROLEUM COMPANY, *Bartlesville, Oklahoma*

Oil-Well Pumping Practices—No. 28

Factors To Be Considered in Back-Side Pumping Hookups

by J. Zaba

DEVELOPMENT of back-side pumping was a result of need for an economical pumping installation capable of pumping several wells. It is interesting to note that development of back-side pumping received great impetus in the early thirties, when depressed crude-oil prices made imperative stringent operating economies. As time progressed, however, and as more efficient, better-engineered back-side pumping equipment appeared on the market, the method of back-side pumping ceased to be an economic expedient and attained a definite place in oil-well pumping practice. The method represents an intermediate step between unit pumping installations and central pumping powers and, under certain conditions, offers a saving, both in investment and in operating expense, when compared with unit or central-power pumping. There are many factors which govern the feasibility of application of the method. Spacing of wells to be pumped, their depth and the amount of fluid to be handled would be primary considerations. Other factors may have their effect such as availability and cost of power, availability of used pumping equipment of other type, plans for future operation of the property, etc. Back-side pumping may be used as a permanent method of operation or as a temporary arrangement for pumping of some of the wells on a property which is to be pumped eventually with a central power.

There exists now in operation a great variety of different types of back-side pumping equipment. Without going into details of construction of different types, all the back-side installations can be, for the purpose of this series, divided into two groups. To the first group would belong installations in which a conventional beam unit, pumping one well, operates, also one or more additional pumping jacks, on one or more additional wells. The power is taken off the unit either through a special crank, the back crank, or directly from the beam. The rod line furnishes the means of transmitting the power to the pumping jacks. The second group would consist of arrangements with pumping jacks only, no beam well being involved. The prime mover, the gear box with two cranks, the pumping pendulum and the knock-offs are all mounted on a rigid steel base as a unit. Such a unit may operate, through rod lines, from two to eight pumping jacks. It can be used either as a permanent installation or as a temporary measure during the transition period of the property from the flowing stage to the stage of central-power pumping.

Design of Installation

In Installment 26 of this series discussion was presented of the concept of rod-line pull. Briefly, the rod-line pull consists of well load decreased or increased, depending on the phase of the stroke of the rod line, by the rod-line friction and rod-line inertia and corrected for the ratio of the polished-rod stroke to the rod-line stroke. With the size of pumping jack determined by the well loads, and size of rod line and rod line's auxiliary equipment by the rod-line pull, the design of a back-side pumping installation narrows itself down to selection of the reducer and of the prime mover.

In the above-mentioned discussion of the rod-line pull formulas were also given for calculation of the maximum and minimum rod-line pulls corresponding to the upstroke and downstroke phases of the well, respectively. Since in a back-side pumping installation the wells are connected in such a way that they balance each other, partially, through the crank shaft, the combined effect on the reducer of the maximum pull of one well and of the minimum pull of another well will have to be considered.

Back-side pumping represents an intermediate step between unit pumping installations and central pumping powers, and, as the author explains in this installment, offers a saving both in investment and operating expense. Here are pointed out the factors which govern the application of the method, which may be used as a permanent method of operation, or as a temporary arrangement for pumping of some of the wells of a property which is eventually to be pumped with a central power.

Selection of Reducer

There are two factors which enter into selection of the reducer of a back-side pumping installation, the overhung load and the net torque. The maximum overhung load depends on the difference of the maximum and minimum rod-line pulls and on the maximum angle of the pitman with the horizontal. The maximum overhung load rating of the reducer[1] must be at least equal to this expected load. The consideration of torque involves the rod-line pull, the crank and rod-line strokes, the hookup of the installation and the number of wells operated.

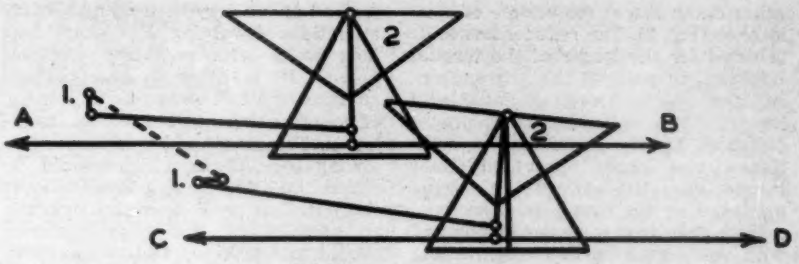
Assume first the case of two wells of exactly equal weight and stroke connected to the stroke-post pendulum of a back-side installation in such a way that they are exactly opposed to each other in their respective pumping cycles. Under such an arrangement the upstroke loads of one well, expressing themselves in the maximum rod-line pull of the well, will produce in the reducer certain torque which will equal the maximum rod-line pull times half of the rod-line stroke. At the same time the downstroke loads of the second well, the minimum rod-line pull, will create in the reducer an opposite torque which will help to neutralize the torque produced by the first well. This torque will equal the minimum rod-line pull times half of the rod-line stroke. The difference between these two torques would be the net torque for which the reducer would have to be designed. Since the maximum and minimum torques of both wells are equal such a torque would be calculated by subtracting the downstroke-load torque of one well from the upstroke-load torque of another well.

As a further step in this reasoning, assume a case of two wells, connected in such a way that they oppose each other, but of unequal weight or stroke. In such a case the net torque during the full pumping cycle of the two wells would not be equal, since the maximum and minimum torques produced by the two wells would not be equal. To assure smooth operation the net torques during each of the two halves of the revolution of the crank would have to be counterbalanced. In a back-side pumping installation the function of counterbalancing may be performed by counterbalanced crank, counterbalanced stroke post or counterbalanced jack. It seems to be a consensus[2,3] that

of handling the unbalanced well.

In the above discussion of the torque on the reducer of a back-side pumping installation two cases have been considered so far. One was the case of two opposed wells of equal weight and stroke, the other was the case of two opposed wells which are not equal in weight or stroke. To arrive at effect of manner of hookup and of number of wells several possible combinations have to be considered.[2,3,4,5]

Two-well arrangement. — This is usually the case of one beam well operating one pumping jack either through back crank (Fig. 1-A) or from the beam (Fig. 1-B). It should be realized that since there is no rod line involved in case of the beam well and since the beam well operates usually with a longer stroke than the jack well, the torques produced by counterbalanced jack is not a satisfactory solution of the problem, since it may induce harmful vibrations into the elastic system. The counterbalanced stroke post has the practical advantage of ease of adjustment of the counterbalance. The ability easily to adjust the counterbalance is particularly important in installations where one of the wells has to be hooked off quite frequently. In such cases either an easily adjustable counterbalancing medium must be provided for the other well or the reducer must be used which is capable



1—1—CRANKS
2—2—STROKE POSTS
A, B, C, D—ROD LINES TO WELLS

Fig. 3—Back-side pumping for four wells

the two wells will not be equal. This is, therefore, the already discussed case of two opposed wells with unequal loads and strokes.

For the back-crank arrangement the back crank is set at 90° to the regular crank. The net torque on the reducer for the two combinations of loads of wells can be calculated from the formulas:

$$T_1 = RLP_{max} \times \frac{S_1}{2} - W_{min} \times \frac{S_2}{2}$$

$$T_2 = W_{max} \frac{S_2}{2} - RLP_{min} \frac{S_1}{2}$$

Where

T_1 and T_2 = Peak torques imposed by each well, inch pounds

RLP_{max} and RLP_{min} = Maximum and minimum rod-line pulls of the jack well, pounds

W_{max} and W_{min} = Maximum and minimum well loads of the beam well, pounds

S_1 = Rod-line stroke of the jack well, inches

S_2 = Crank stroke of the beam well, inches

The necessary counterbalance would equal half of the difference of the two torques:

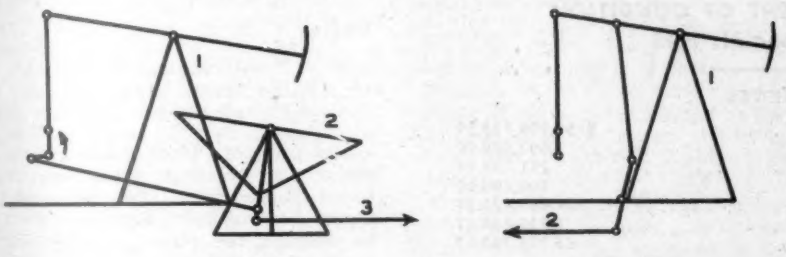
$$C - B = \frac{T_1 - T_2}{2}$$

Where

CB = Effective counterbalance, pounds

and other terms are as in previous formulas.

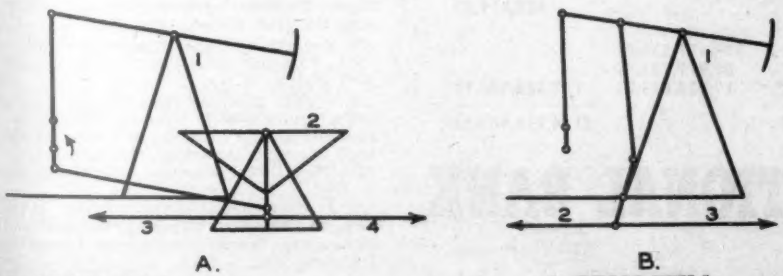
Similar calculations apply to arrangement under which the second well is pumped from the beam.



1—BEAM WELL
2—STROKE POST
3—TO SECOND WELL

1—BEAM WELL
2—TO SECOND WELL

Fig. 1—Back-side pumping for two wells



1—BEAM WELL
2—STROKE POST
3—TO SECOND WELL
4—TO THIRD WELL

1—BEAM WELL
2—TO SECOND WELL
3—TO THIRD WELL

Fig. 2—Back-side pumping for three wells

Three-well arrangement.—This case usually includes one beam well with two jack wells. For arrangement using back crank (Fig. 2-A) the back crank is set 180° from the main crank. The two wells on the back crank are opposed. The reducer would be selected for the greater of the two torques, the torque produced by the beam well and the torque produced by the back-crank wells.

Two back-side wells pumping from the beam of a third well (Fig. 2-B) would represent a case of two wells opposed to one. The reducer would have to be selected for the torque equaling the sum of torques created by the back-side wells and by the beam well. This would required larger reducer than needed for three wells under the back-crank hookup.

Four-well arrangement.—This case covers a pumping unit, operating four or more jack wells with no beam well involved. The cranks are set at 90°, the two wells on each crank being opposed to each other and properly counterbalanced. Under such a hookup the two wells on one of the cranks are respectively on top and bottom of their strokes, while the wells on the

other crank are at the middle of their strokes (Fig. 3). The reducer has to be selected for the larger of the torques imposed by each of the two cranks. In other words a reducer capable of handling two wells can, under proper hookups, handle satisfactorily additional two wells, provided their torque does not exceed the torque produced by the first pair of wells.

More than four wells can be pumped with this arrangement by connecting additional rod-line wells to the knockoffs. The rod-line pull at a knockoff would in such a case equal the sum of the pulls of the wells connected.

The pumping unit of the type described above may be used also in installations involving less than four jack wells with no beam well involved. R. E. Bridges presented[6] an analysis of effect on torque of manner of counterbalancing of such an installation. This analysis leads to the following conclusions which should be added to previous considerations: (1) With one well operated by such an installation the counterbalance should be on the opposite crank. The counterbalanced crank should lead or lag by 90° depending on direction of operation, and (2) for three-well arrangement the counterbalance weight should be on the two-well crank. This crank should be 90° from the one-well crank.

Torque Analysis

The preceding considerations covered determination of peak torque for the purpose of selecting the reducer for a back-side pumping installation. In an existing installation it is sometimes necessary to make complete analysis of the torque conditions with view of improving the efficiency of the installation. Such analysis can be made with data secured from dynamometer cards[3] using a method similar to that outlined in Installment 14 of this series. By dividing the card into the degrees of crank rotation, loads of both the main well and the back-side well can be read directly from the card for different positions of the crank. Thirty-degree intervals are generally used. Effective loads and the torques are then calculated for different positions of the crank. The tabulated data thus secured can be then plotted on polar coordinate paper. This manner of presentation of torque conditions suggests readily possible corrections needed for improvement of operations.

Power Requirements

J. C. Slonneger suggests following formula for calculations of power requirements of a back-side pumping installation[4]:

$$HP = \frac{P \times D}{66{,}000}$$

Where

HP = Power required, horsepower
P = Production, barrels per day
D = Pumping depth, feet

The formula, which proved satisfactory in practical application, is based on assumption that the prime mover has sufficient flywheel effect to average the power requirement peaks so that the calculation of the prime mover can be based on average power requirements.

Bibliography

1. A.P.I. Specifications for Rating of Steel Helical and Herringbone Geared Speed Reducers for Pumping Machines; A.P.I. Standards No. 11-E, 4th ed., Aug. 1941.

2. Kenneth N. Mills: "Selection of Back-Side Pumping Equipment," Oil Weekly, May 1939, p. 15.

3. Eugene Hosford: "Determining Torque on a Multiple-Well Hookup From Dynamometer Data," Proceedings Twentieth Annual Meeting, American Petroleum Institute, Nov. 1939, Production Bulletin No. 224, p. 270.

4. J. C. Slonneger: "Back-Crank Problems and Rod-Line Pumping," Drilling and Production Practice, American Petroleum Institute, 1939, p. 249.

5. Van D. Bennett: "Back-Side Crank Pumping in Kansas Fields," Petroleum Engineer, May 1935, p. 31, June 1935, p. 22.

6. R. E. Bridges: "Back-Side Crank Pumping and Catenary Rod Lines," Drilling and Production Practice, American Petroleum Institute, 1936, p. 69.

AMPLE RESOURCES . .
AMPLE FACILITIES
for Serving the Vital Oil Industry

CONDENSED STATEMENT OF CONDITION
As of December 31, 1943

RESOURCES

Loans and Discounts		$ 59,998,126.39
Banking House		1,887,000.00
Furniture and Fixtures		271,184.44
Stock in Federal Reserve Bank		300,000.00
U. S. Government Securities		64,845,976.34
State, Municipal and Other Securities		1,232,894.99
Cash in Vault and with Banks		55,776,782.37
Total		$184,311,964.53

LIABILITIES

Capital	$ 5,000,000.00	
Surplus	5,000,000.00	
Undivided Profits	1,051,000.00	$ 11,051,000.00
Reserve for Taxes, etc.		822,819.39
DEPOSITS:		
Individual	$94,497,534.01	
Banks	58,919,737.90	
U. S. Government	19,020,873.23	172,438,145.14
Total		$184,311,964.53

REPUBLIC NATIONAL BANK
OF DALLAS
ONE OF THE NATION'S 100 LARGEST BANKS
REPUBLIC BANK TRAVELERS CHECKS
sold by authorized banks and agencies. Cashed throughout the world, including all branches of Thos. Cook & Son. Use them when traveling.

A.I.M.E. DIGESTS

On this and the next several pages are presented digests of technical papers presented before the annual meeting of the American Institute of Mining and Metallurgical Engineers, which was held at New York City, February 20-24

Positive Colloid Muds

by Donald C. Bond*

SUSPENSION of clay in water is a typical colloidal system whose properties depend to a large degree on the fact that the suspended particles all carry electrical charges of the same sign; ordinary clay particles carry negative charges. When two negatively charged particles approach one another, the electrical forces of repulsion hinder the coalescing of the particles. The result is a more or less stable suspension.

A colloidal-clay particle bearing negative charges is always surrounded by positive ions, the sum of whose charges is equal to the total negative charge on the particle. These positive ions generally may be replaced by other ions, so they are called the replaceable base of the clay.

The properties of a clay vary enormously. Natural kaolin, which has a very low base-exchange capacity, settles rapidly from suspension. Bentonite which has a high base-exchange capacity, forms permanent suspensions. Clays containing sodium as the replaceable base are usually highly dispersed in suspension and relatively impervious to water when filtered. Calcium clays are generally porous and granular and cannot be maintained in stable suspension.

Any agent that decreases the charge or the potential of a colloidal particle is said to have a "flocculating" effect on the particle. The addition of a calcium-chloride solution to a sodium-clay suspension reduces the electrical potential of the sodium clay and it is partially flocculated. Sufficient salt of aluminum or thorium will reduce the charge on the clay colloid to zero, completely flocculating the clay.

Any agent that increases the charge of the particles of a colloid is said to have a deflocculating effect because it raises the stability of the colloid. Sodium tannate and complex sodium phosphates are typical deflocculating agents for clay suspensions.

*The Pure Oil Co., Winnetka, Ill.

As a general rule, any electrolyte that acts as a good deflocculating agent for negative colloids will act as a flocculating agent for positive colloids, and vice versa. Large amounts of any electrolyte have a flocculating effect on both positive and negative colloids. Certain organic solvents have a similar effect on hydrophilic colloids such as clay.

Bentonite containing sodium as the replaceable base, swells in water to many times its dry volume.

Dialyzed bentonite, containing no base, does not swell when placed in water, indicating that swelling is caused by the hydration of the exchangeable base. To minimize the swelling of bentonite, one should replace the highly hydrated sodium base with another base that is less hydrated, such as calcium or aluminum. If the negative charge on the bentonite particle were completely neutralized, it should exhibit no swelling in contact with water.

Ordinary bentonite exerts a measurable osmotic pressure, while dialyzed bentonite does not. Any agent that will reduce the thermodynamic activity of water, such as salts in high concentrations, should reduce the swelling of bentonite.

(The author then discusses various fluids, chemical processes and mechanical methods used or proposed for drilling through heaving shale.)

Consideration of the properties of bentonite led to the conclusion that a mud containing positively charged colloidal material, rather than ordinary negative clay colloids, should be satisfactory for drilling bentonitic shale. Placed in contact with a positive colloid, bentonitic shale should be flocculated because of the neutralization of the negative charge on the bentonite. The surface bentonite should also be neutralized. In either case neutralization of the charge on the bentonite would prevent swelling of the shale. Furthermore, the pH range over which positive colloids are stable is slightly on the acid side, where the hydration and swelling of bentonite are very small. Therefore heaving shale should not swell or disintegrate when in contact with a positive colloid mud.

There are no naturally occurring positive colloids having properties essential in a drilling fluid. It has been known for some time that positive colloids can be made by the addition of powerful deflocculating agents (for positive colloids) to suspensions of various negative colloids. A suspension of negatively-charged bentonite can be converted to a positive colloid by the addition of salts of thorium and other polyvalent cations, acid gelatin and other proteins, or basic dyes such as methylene blue and methyl violet. Having the most promise as drilling muds are those formed by the addition of basic dye solutions to suspensions of bentonite.

Table 1 shows the results of some typical experiments with mixtures of bentonite and basic dye in contact with heaving shale showing that the theoretical conclusions are borne out by actual tests.

TABLE 1—EFFECT ON HEAVING SHALE OF ADDITION OF BASIC DYE TO BENTONITE

Mixture No.	5 per cent bentonite suspension* (cc.)	5 per cent methylene blue added (cc.)	Charge on colloid†	Effect on heaving shale‡
1	20	0	Negative	Swells and disintegrates in less than 3 hours
2	20	1	Negative	
3	20	2	Negative	
4	20	3	None detectable	
5	20	4	None detectable	Swells and disintegrates in less than 12 hours
6	20	7	None detectable	
7	20	10	None detectable	
8	20	15	Positive	Unchanged in 5 days
9	20	20	Positive	

*Mixtures diluted to 100 cc. with distilled water. †Charge as determined by cataphoresis experiment. ‡Shale cuttings from 1 W. W. Smith, Brazoria County, Texas.

TABLE 1—RESULTS OF TESTS ON METHYL VIOLET BENTONITE MUDS CONTAINING WHEAT FLOUR

Mud No.	Composition of mud by weight, per cent: Bentonite	Methyl violet	Wheat flour	Diglycol Laurate	Baroid	Sp. gr.	pH	Stability: Free liquor (cc.)	Sp. gr. of top layer	Stormer viscosity tests: Viscosity centipoises	Initial gel strength (grams)	10-minute gel strength (grams)	100 lb. filter test, 120° F. 16 sq. in.: Filtrate in 30 min. (cc.)	k*
1	0.67	1.33	5.00	0.1	42.8	1.5	5.8	0	1.48	155	5	60	6	0.5
2	0.67	1.33	4.00	0.1	42.8	1.5	6.4	0	1.42	89	4	50	13	0.9
3	0.67	1.33	3.33	0.1	42.8	1.5	6.2	0	1.40	57	3	45	11	0.8
4	1.33	2.00	2.67	0.1	42.8	1.5	6.0	0	1.44	55	6	60	16	1.3
5	0.67	1.33	2.67	0.1	42.8	1.5	6.4	0	1.38	46	3	30	1	0.5
6	1.00	2.00	2.67	0.1	42.8	1.5	6.2	0	1.40	46	4	30	18	1.9
7	1.00	2.00	3.33	0.1	42.8	1.5	5.9	0	1.44	71	4	40	14	1.9

No effect on heaving shale was perceptible in 3 months

*Units of k are $\frac{\text{cc.}}{\sqrt{\text{min.}}}$ for 16 sq. in. filter.

It is possible to prepare mixtures containing only bentonite and basic dye that are fairly satisfactory for drilling mud but they can be greatly improved by the addition of certain substances. The dye-bentonite mixtures have a tendency to form a stable foam which can be eliminated by the addition of a small amount of diglycol laurate or a similar compound.

Certain properties of dye-bentonite muds, such as stability, gel strength, and filtration characteristics, are greatly improved by incorporating a small amount of wheat flour or starch in muds. The flour or starch does not undergo decomposition by organisms because of the preservative action of the dye in the mud.

Muds having high specific gravities are obtained by the addition of barites, as with ordinary muds.

The results of tests on some representative methyl violet bentonite muds are given in Table 2.

Little Change in Properties

After standing at high temperatures for a long period of time, these muds undergo little or no change in properties. Corrosion tests were made on representative colloid muds, saturated with air, in contact with metals similar to those used in drilling. It was found that the loss in weight due to corrosion was negligible.

The behavior of muds toward various formations encountered during drilling can be determined only by means of actual tests in the field but because of the superior sealing qualities of the mud it should be possible to prevent infiltration of formation water by increasing the specific gravity of the fluid. There is a possibility of interaction between the dye and finely ground and pulverized limestone cuttings, resulting in the removal of the dye from the mud; larger cuttings should have little effect. It is believed that the amount of lime ordinarily encountered in heaving shale areas is not large enough to cause serious trouble.

The positive colloid muds described possess certain distinct advantages over silicate muds which so far are the most nearly satisfactory for drilling heaving shale.

In the silicate muds the liquid suspension medium usually consists of two-thirds D-brand sodium silicate, by volume, plus one-third saturated sodium-chloride solution. This strongly alkaline and saline mixture has a great flocculating effect on ordinary negative clay colloids as such colloids form stable dispersions only in the pH range from about 8 to 12 and in the absence of high concentrations of electrolytes. Clay and bentonite present in silicate muds are not dispersed in the form of electrically charged, hydrated, colloidal particles. These particles do not settle rapidly because of the high viscosity of the mixture. The flocculating nature of the silicate mixture prevents the swelling and disintegration of heaving shale. The wall-sealing properties of the silicate muds are due to the high viscosity of the liquid-silicate-suspension medium.

The positive colloid muds contain highly hydrated, colloidally-dispersed particles bearing positive electrical charges. In contact with heaving shale the methyl violet (or other basic dye) neutralizes the natural negative charges in the surface of the shale particles. After neutralization the shale cannot swell for the ions whose hydration causes swelling (sodium, potassium, etc.) have been replaced by dye ions.

TABLE 2—ELECTRICAL RESISTIVITIES OF DRILLING MUDS AT 77° F.

Mud No.	Description of mud	Type of mud	Resistivity, ohms per meter cubed
1	Resistivity most desirable for electrical logging of shale		Approx. 2.00
2	1 W. W. Smith, Brazoria County, Texas	Silicate	0.18
3	1 Minnie Brown, Alice Texas	Silicate	0.19
4	No 2, Table 2	Positive colloid	3.1
5	5 Stewart-Dickinson, Dickinson, Tex.	Aqueous	6.5
6	1 Wells, Clay City, Ill.	Aqueous	4.0

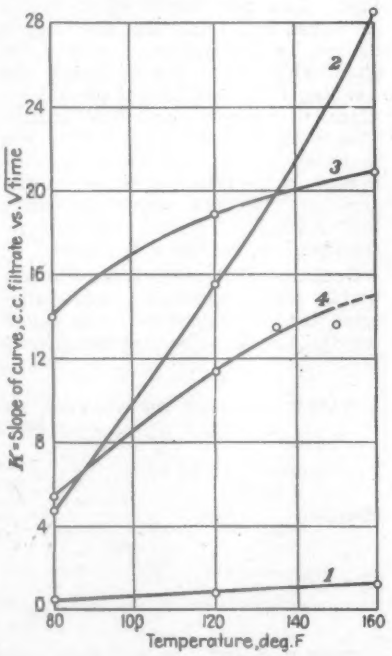


Fig. 1—Filtration characteristics of various muds at different temperatures.

1—Positive colloid mud (No. 3 in Table 2)

2—Silicate mud, 1 W. W. Smith, Brazoria County, Texas

3—Aqueous mud; average from Clay City, Ill.

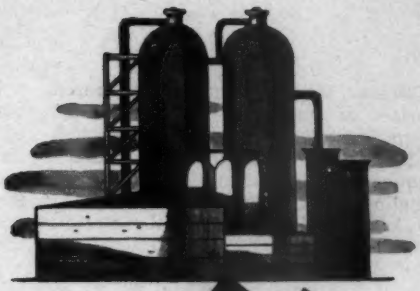
4—Very good aqueous bentonitic mud, 3 Gatewood Newberry

Cause of Sealing Ability

The sealing ability of the positive colloid muds is caused by the presence of colloidal material that is almost impermeable to water, even at high temperatures. Fig. 1 shows the differences in values of the filtration, or sealing, constant for representative silicate, positive colloid and aqueous muds, at various temperatures. The very low values obtained for positive colloid muds show that they seal very rapidly and undergo only a slight change when the temperature is increased from 80° to 160° F.

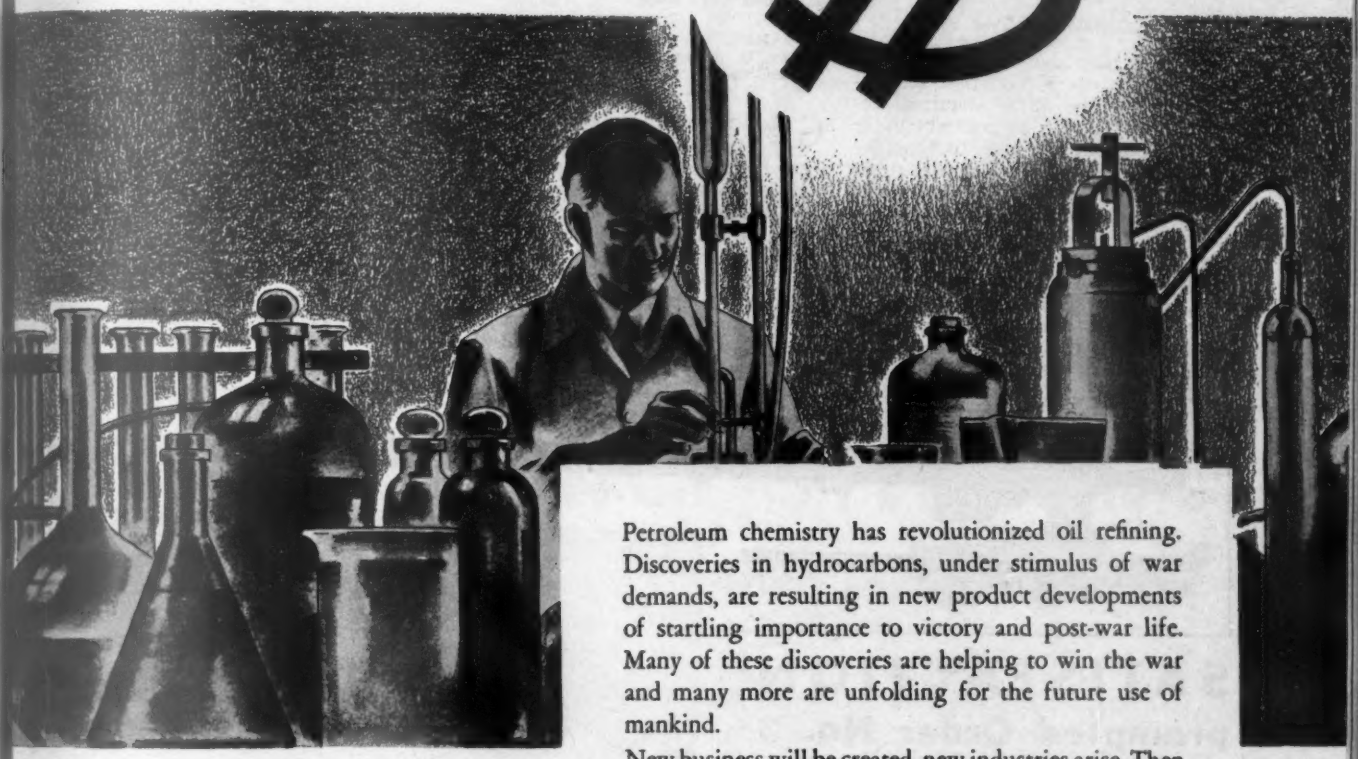
The silicate mud loses much more

A finer, more abundant living
TODAY and TOMORROW
because of Petroleum Chemistry



Millions $

FOR RESEARCH, HAVE CAUSED A REVOLUTION IN OIL



Petroleum chemistry has revolutionized oil refining. Discoveries in hydrocarbons, under stimulus of war demands, are resulting in new product developments of startling importance to victory and post-war life. Many of these discoveries are helping to win the war and many more are unfolding for the future use of mankind.

New business will be created, new industries arise. Then will the world more fully appreciate the extent of oil industry's great contributions to more abundant living.

The Tret-O-lite Company has long shared in the service of the oil industry, providing accurate field tests and chemical compounds for crude oil demulsification.

Crude oil must be treated efficiently and economically. Tret-O-lite compounds, effective and fast, solve all emulsion problems. A capable field engineer, always available, will make tests and recommend the proper compounds to use.

Complete Service for Every Field

TRETOLITE COMPANY · *Manufacturing Chemists*
Webster Groves, St. Louis County, Mo. • Los Angeles, Calif.

Oil is Ammunition • Treat it Right

Tret-O-lite
REG U S PAT OFF

DEHYDRATING **DESALTING**

filtrate. More serious is its rapid losses of ability to seal when the temperature is raised so that in this respect it is worse than an ordinary aqueous clay mud at 160° F. Loss of sealing ability appears to be due to lack of colloidally dispersed material. Viscosity of the filtrate obtained from the silicate mud (No. 2 in Fig. 1) is about five times as high at 80° F. as it is at 160° F. This corresponds approximately to changes in the filtration constant for that mud. Viscosity measurements made on positive colloid and silicate muds show that the latter increase much more rapidly with temperature decreases than the former. From 135° to 77° F. the viscosity of silicate mud almost doubles while colloid muds show a 50 per cent change in viscosity.

Resistivities of Two Muds

It is desirable, for electrical-logging purposes, to use a mud that has approximately the same electrical resistivity as the formation, which for shale is about 2 ohms per meter cubed. Silicate muds are less than one-tenth of the desired value and surveys taken with such mud in the hole are distorted and relatively inaccurate (Table 3). Positive colloid muds have resistivities approaching that of shale (3.3 ohms per meter cubed) so an accurate, undistorted electrical log can be obtained in a hole filled with this material.

Initial cost per barrel of positive colloid mud is about 25 per cent higher than silicate mud but because of its superior sealing qualities, particularly at high temperatures, less of the former will be required. Difference in initial cost would be more than offset by saving of fluid.

Positive colloid muds have not yet been tested in the field because of restrictions on the use of dyes. At the close of the war there should be a large potential production capacity for dyestuff intermediates and dyes. This may make it possible to prepare positive colloid muds in large volumes at a cost somewhat less than silicate muds.

Air and Gas Lifts

R. V. HIGGINS, Associate Petroleum Engineer, U. S. Bureau of Mines, San Francisco, Calif.

GAS lifts offer numerous proved advantages. They have a large capacity, have no moving parts in the well, are adaptable to deep wells and crooked holes, and can handle considerable silt. They may also be used to control back pressures on producing formations, in order to decrease some formation gas-oil ratios and to control the coning of bottom water. In addition, the fluid mechanics of gas lifts are somewhat similar to that of natural flowing wells; therefore, a detailed knowledge of the fluid mechanics of gas lifts might be used to prolong the natural flowing life of the wells.

The lifting of water by air has none of the solubility problems that are associated with gas lifts and natural flowing wells. Therefore it was thought that if it were possible to find a somewhat accurate method of designing air lifts of different sizes so as to operate at their maximum efficiency, progress would be made toward the science of predicting the performance of gas lifts and natural flowing wells. A method of designing air lifts ranging from 40 to 100 ft. in length and operating at maximum efficiency was devised. Tests on the results of the method of design indicate that they are within an average of 5 per cent of the true values.

Additional studies of air lifts were made to extend the range of the design, but it was found that sufficient data are not available. It is believed, however, that the principles of the method of design can easily be extended when more experimental data are available.

A study of the air lift shows that when lifts are operating at maximum efficiency, the mean velocity of air and water mixtures varies slowly with the pipe diameter but rapidly with the submergence ratio, indicating that the amount of submergence

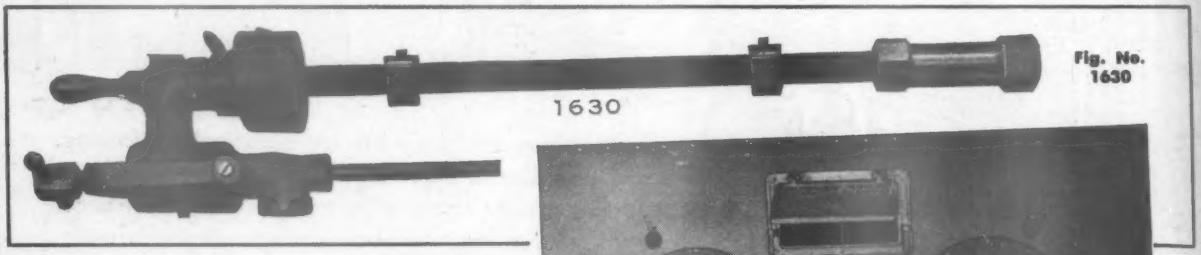


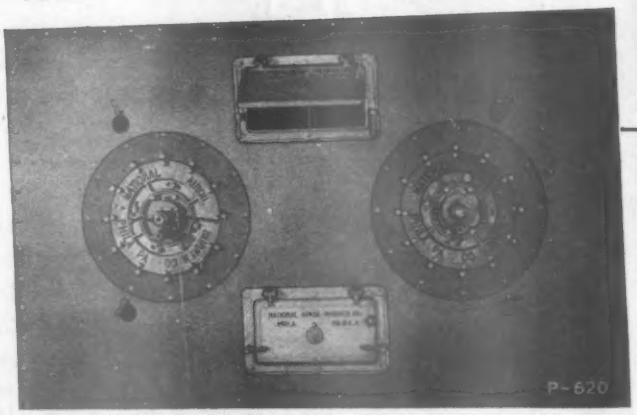
Fig. No. 1630

SATISFACTION
prompted Order No. 3

Two Universal Registers, shown at the right, installed in the forced draft wind box of a 70,000 pounds per hour high pressure steam generator for use with

NATIONAL AIROIL
MECHANICAL ATOMIZING OIL BURNERS

is the third similar installation ordered from us by one user. The original had given such complete satisfaction with regard to fuel efficiency, ease of regulation and low maintenance, that repeat orders were the logical solution to the need for increased capacity.



The Type M A Mechanical Atomizing Burner is provided for those installations where it is necessary to atomize solely by means of the fuel oil pressure. It has been time tested in a variety of applications. Can we tell you more about it?

NATIONAL AIROIL BURNER
COMPANY, INCORPORATED
1236 East Sedgley Avenue
PHILADELPHIA 34, PENNA.

OIL BURNERS • GAS BURNERS • GAS PILOTS • PUMP SETS • EXPLOSION DOORS • ACCESS DOORS • AIR DOORS • BURNER BLOCKS • FURNACE OBSERVATION WINDOWS

is a very important variable. Usually submergence is neglected in velocity studies of oil wells. In oil wells, the ratio of the pressure at the well head to the pressure at the bottom of the tubing is roughly comparable to the submergence ratio in air lifts.

Since the proved advantages of lifting of oil by compressed gas are many, a study was made of the less complex air lift to obtain additional knowledge of some of the basic factors controlling the performance of the lifting of liquids by compressed gas. A study was made to find the dimensionless ratios pertaining to known air lifts operating at maximum efficiency so that correlations between these dimensionless ratios could be used to calculate the performance of new air lifts.

Results of Study

The more pertinent results of the study are:

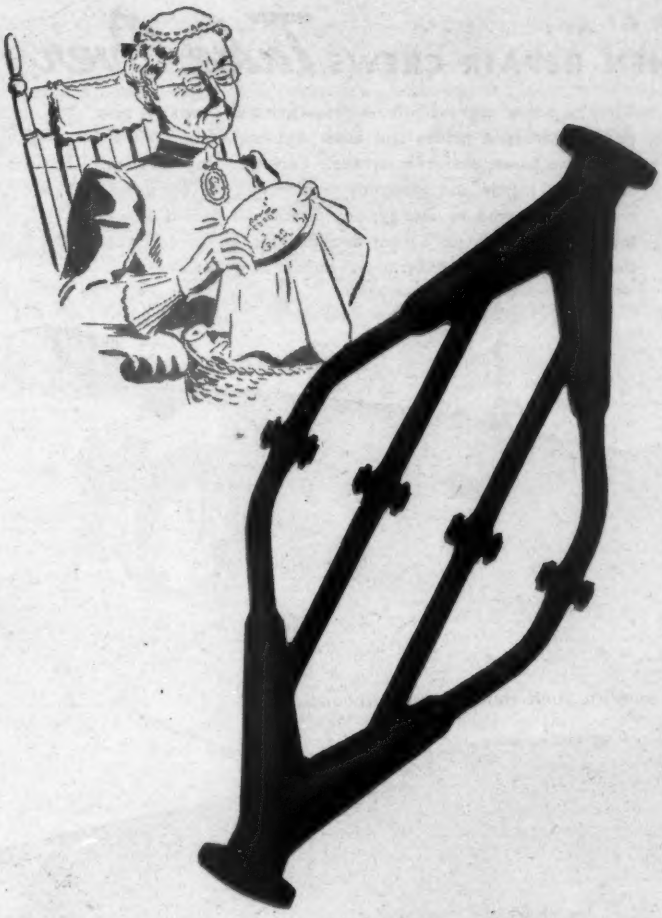
1. A good correlation was obtained between the dimensionless ratios L/n (L = length of the tubing, n = height the water is lifted) and R 1n r/(r — 1) (R = gas-liquid ratio, 1n = natural logarithm, and r = ratio of the pressure at the inlet to that at the outlet of the eductor pipe) for pipes 27 to 100 ft.—and possibly much longer when additional experimental data are available to test the extrapolations beyond 100 ft.—of air lifts operating at their maximum efficiency. The length of the pipes is a parameter, and for lengths more than 35 ft., the rate of variation with the dimensionless ratios is small. From the correlations of these dimensionless ratios, the gas-liquid ratio and efficiency can be calculated easily for any given L/n.

2. The diameter of the tubing and the air rate for a given water rate when the system would operate at maximum efficiency can be ascertained by means of an equation developed from the correlation between L/n, R 1n r/(r — 1), and the mean velocity of mixtures of air and water. Checks on the calculated design results show that they are within an average of better than 5 per cent, thus making it possible to design air lifts rather accurately.

3. A study of air lifts operating at maximum efficiency shows that the mean velocity of air and water mixtures varies slowly with pipe diameter but varies rapidly with changes in submergence ratios. In velocity studies of oil and gas mixtures in oil wells, the submergence factor is usually neglected. In oil wells, the ratio of the pressure at the bottom of the tubing to that at the well head is roughly comparable to the submergence ratio in air lifts.

4. The following factors influence gas-oil ratios of natural flowing and gas lift wells according to a study of air lifts:

(a) There is a most efficient flow



FANCY STITCHING
with Flame and Steel

This rather oddly designed 1000 lbs. of carbon moly fabrication was brought into actuality by the skill and experience of the men in Associated's shops. Their thorough knowledge and utilization of all advanced welding procedures, and the application of modern, pre-heating, stress-relieving equipment is indicated in work of such intricate pattern. One of many and varied fabrications now in process at Associated for critical war projects, this particular job is for use in a high octane plant ... *The more difficult the job the more reason for calling in Associated.*

ASSOCIATED PIPING & ENGINEERING CO., INC.
2332 EAST 38TH STREET
LOS ANGELES 11, CALIFORNIA

WHEN REPAIR CREWS *Take Over*

They're doing a great job — those ground crews — repairing damaged planes and other fighting equipment at front line bases, and everywhere. For operating riveters and other repair and assembly equipment, air compressors are powered by sturdy, dependable air-cooled gasoline engines. One more front line duty for the hundreds of thousands of Briggs & Stratton engines now "In Service".

Just as Briggs & Stratton engines have been war-proved, so have our facilities for manufacture. The way those rugged, dependable engines have come through with flying colors is definite proof that Briggs & Stratton high standards of quality materials and precision manufacture could be, *and are being* maintained in face of wartime production schedules.

Our engineering and production staffs are geared up to help you on present war needs, or on your planning now for future production of gasoline powered equipment.

"It's powered right — when it's powered by Briggs & Stratton."

BRIGGS & STRATTON CORP.
MILWAUKEE 1, WISCONSIN, U.S.A.

BACK THE ATTACK
BUY WAR BONDS

4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES

rate of oil above or below which a higher gas-oil ratio is required.

(b) Lowering the tubing in wells increases the submergence ratio, thereby increasing the efficiency and at the same time reducing the gas-oil ratio required to lift the oil.

(c) Increasing the back pressure at the bottom of the wells increases the submergence and depending on the pressure at the well head may increase the efficiency of the flowing well and decrease the gas-oil ratio required to flow the well.

Mechanical Side-Wall Coring in a Bore Hole

A. W. WADDILL, Vice President, Houston Oil Field Material Co., Inc.

WITH the introduction of electric logging, an entirely new technique in stratigraphic determination was evolved which has become conventional practice. Wells are drilled to their contract depth, as quickly as straight hole demands will allow, and are then electrically logged to determine formation breaks. Stratum cores are taken and casing is run into the hole immediately. With the bore hole safely cased, sufficient time is allowed to study the electric log and examine laboratory analyses of the side-wall cores. Upon determining the producing horizon to be tested, casing is perforated in the usual manner and the operation is complete.

A mechanical side-wall coring device with retractable core barrel operating through the drill pipe as it remains in the hole, permitting maintenance of circulation and resultant mud conditioning, is described. At depths of 5,000 to 10,000 ft., cores may be taken and withdrawn by wire line at the rate of approximately one per hour. The well is drilled to a predetermined depth and stratigraphic breaks are tested from the bottom of the bore hole to the top in one continuous series of coring operations and with one round trip of the drill pipe. Any formation drillable at the rate of 3 to 4 ft. per hour, or faster, with a rock bit may be cored. Cores measure approximately 1¼ in. in diameter and 4 ft. to 10 ft. in length. Length of the core is governed by the length of the core tube and by the hardness of the formation.

The device has been used repeatedly by all major and most independent oil companies. Bore holes have been successfully side-wall cored at depths ranging from less than 600 ft. near Bakersfield, Calif., to below 12,000 ft. in the Golden Meadow field of southern Louisiana. Hole diameters have ranged from 6¼ in. to 12¼ in. Side-wall cores have been taken in Texas, Louisiana, Arkansas, Oklahoma, California, Mississippi and Alabama. Tools have been exported to several countries in South America and to the South Pacific.

Waters From the Frio Formation, Texas Gulf Coast

FRANK W. JESSEN and F. W. ROLSHAUSEN, Humble Oil & Refining Co.

BRINES have been studied for many years in an attempt to solve some of the geologic and production problems associated with the production of oil and gas. One practical application of study of water analyses is the correlation of waters occurring above, in, or below the producing sand in the same field or throughout the same formation.

It is the purpose of this paper to present data on brines occurring in the Frio formation of the Texas Gulf Coast, and to show how their composition varies, (1) with depth below the surface, (2) with depth below the top of the formation, and (3) along the approximate strike.

Variance in Chloride Content

The brines vary in chloride content from 3,180 to 73,000 p.p.m., though the average salinity of the salt waters is shown to vary with total depth; the concentration being 35,000-40,000 p.p.m. at 4,500-5,500 ft. and above 50,000 p.p.m. chloride at 5,500-6,500 ft.

In all, 88 analyses from 50 fields and 4 wildcats, from depths ranging from 2,500 to 11,400 ft. below the surface and from 2 ft. to 2,686 ft. below the top of the Frio are recorded.

In following the variations in chemical composition and concentration of water from wells in Starr County to Jefferson County, some interesting features are apparent. In passing northward a gradual increase in chloride content of the waters in this area is apparent, though no increase in concentration with depth is noted.

It is evident, from a tabulation of the individual values of chloride ion determined in the 116 waters analyzed, that a trend is indicated of decreasing salinity with depth. It also shows the predominance of waters with high concentrations of dissolved salts in the upper 400-500 ft. of formation.

A curve showing the distribution of samples containing less than 40,000 p.p.m. of chloride, approximately twice the concentration of present day sea water, reveals that, from a depth of 300 ft. to 1,500 ft. below the top of the Frio, the waters obtained

VARIATION IN CHEMICAL ANALYSIS OF GULF COAST FRIO WATERS

County—	Sodium	Calcium	Magnesium	Chloride	Sulfate	Bicarbonate
Starr	7,395-13,802	344-2,444	50- 90	12,896-25,696	0-1,400	110-842
Hidalgo	6,933-19,591	95-1,640	44-270	10,912-31,218	0-3,672	84-909
Jim Wells	8,257	738	35	14,000	110	128
Kleberg	10,634-13,756	1,570-2,400	10- 24	19,000-25,300	54- 160	201-384
Nueces	5,809-25,551	195-2,148	18-241	8,750-54,500	0- 30	140-805
San Patricio	29,282	2,925	589	51,783	.....	148
Brooks	13,502-18,941	2,460-3,032	60-170	25,286-34,700	12- 32	86-610
Refugio	23,284-27,758	626-2,620	175-410	40,900-45,200	0-Trace	110-519
Calhoun	24,154	984	225	39,500	.....	311
Jackson	18,229-25,643	652-1,832	68-307	30,000-41,500	0- 27	183-488
Matagorda	17,216	692	243	27,900	.....	994
Wharton	19,957-30,583	870-2,352	109-376	32,400-52,000	0-Trace	390-817
Fort Bend	30,980-39,600	1,705-5,100	322-1,160	54,000-73,000	0- 49	122-314
Brazoria	15,620-38,852	638-1,804	29- 414	24,500-64,000	0- 86	183-976
Galveston	16,542-39,996	512-4,350	41- 496	26,700-67,012	0- 101	98-885
Harris	11,903-40,800	375-4,740	105-1,007	19,000-67,300	0- 62	116-230
Montgomery	2,243	32	16	3,180	20	512-*80
Chambers	31,116-42,472	1,286-4,310	220-612	57,000-71,000	Trace-50	146-854
Jefferson	11,869-40,100	348-2,970	79-764	18,900-69,100	0- 103	27-659

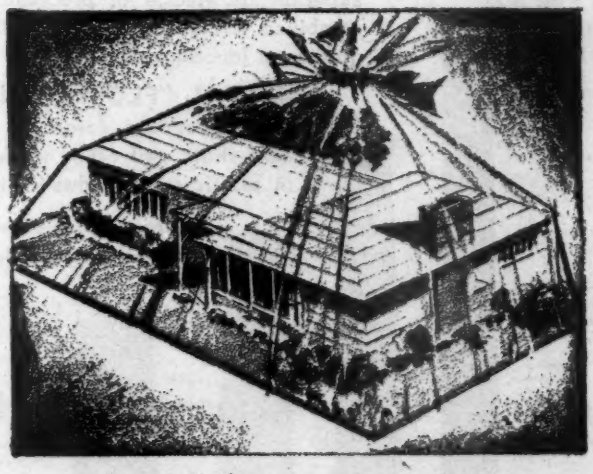
*CO_3

We're Working on

Big Plans

for POST-WAR low-cost

HOUSING



While our entire facilities are engaged in Government war work, our planning and research departments are not idle. We are working on a low-cost, prefabricated house for the post-war period, based on our 25 years in this field.

We are committed to a policy of distribution and sale of prefabricated houses through established dealers, and we'll have a surprise package for you in the form of a smart, modern home and a packaged plan which can be used with profit.

As soon as we have specific information on our packaged plan, it will be sent in the order that inquiries are received. Write us now, so that you will receive this information.

HOUSTON Ready Cut HOUSE CO.
Prefabricators Since 1917
POLK AVENUE HOUSTON, TEXAS

yield a chloride content of more than 40,000 p.p.m. whereas below this depth the majority of waters show decreased amounts of total dissolved salts.

Depth of Penetration

Data obtained from wells approximately paralleling the Gulf Coast shore line from Starr County to Jefferson County including the approximate top of the Frio, the depth of the sample and the chloride concentration reveal that a considerable depth of penetration into the formation has been obtained in several wells in Starr, Kleberg and Nueces counties. The remainder of the section shows much less penetration though in Refugio and Jackson counties some deeper samples were available. With only one exception, the highest concentration of salts occurs in the upper part of the Frio formation penetrated.

In only one area were samples available to show a partial dip section. This occurs through Montgomery, Harris and Galveston counties. A curve, plotting the depth of samples, top of Frio formation, and chloride concentrations of samples from 3,160 ft. total depth to 10,400 ft. total depth, shows that except for the waters from League City the maximum concentration of chloride occurs in the upper part of the Frio, and that going downdip to depths of 4,500 ft. to 6,500 ft. increased salinity is observed.

Water samples are available from four piercement-type salt domes, namely, Big Creek, Sugarland, Pierce Junction and Danbury. These waters show that the Frio sands from which the samples were obtained are not in contact with the salt. If these sands were in contact with the salt, it would be expected that much higher chloride concentrations would occur.

Summary

A compilation of 116 water analyses from 63 fields and 14 wildcat wells from the Frio formation of the Texas Gulf is presented. A few trends are apparent though it is realized that additional analyses may confirm or even reverse them.

1. The chloride salinity increases and the sulfate salinity decreases from Starr County northward.

2. The chloride salinity increases with depth downdip and reaches a maximum value between 4,500 ft. and 6,500 ft. and apparently decreases with depth below 6,500 ft.

3. The chloride salinity seems to have a maximum value in the upper 500 ft. of the Frio and to decrease as a greater interval of Frio formation is penetrated. This is especially evident in Harris and Fort Bend counties.

4. No definite conclusions may be drawn from this observation, however, as to the possible relationship between this concentration of salts in the upper Frio and oil and gas accumulation, to the changes which may have been effected in the waters by contact with oil or gas, since an insufficient number of samples is available for study.

5. These waters show that the Frio sands from which the samples were obtained are not in contact with the salt. If these sands were in contact with the salt, it would be expected that much higher chloride concentrations would occur.

As previously stated, since this study was intended only to present as much data as possible on the waters from the Frio, no attempt has been made to present any solution to the practical and theoretical problems involved in the study of brines so ably summarized by Washburne and Lahee.

The wide area in which only a few samples are available from numerous sands of the Frio formation prevents conclusive statements at this time regarding the waters. It is hoped that additional analyses of brines from the many sands of the Frio formation may become available.

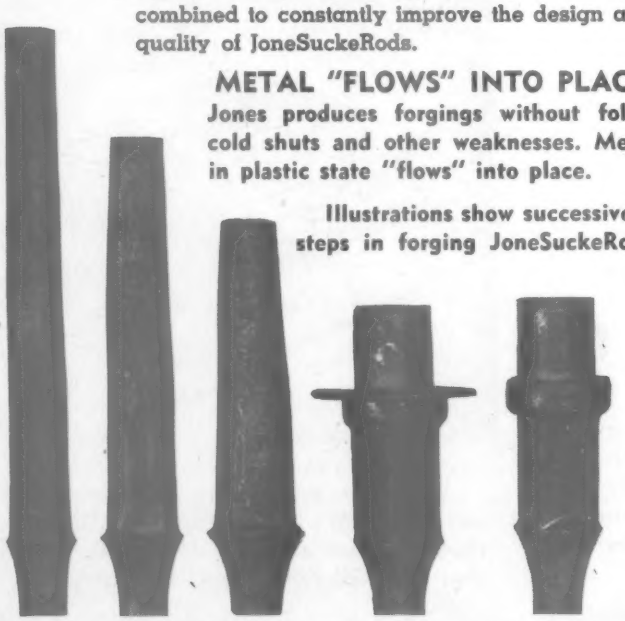
YOUR Oil Production PROBLEM
Is OUR Rod Production JOB!

It is our job to produce Jones Sucker Rods that will help you solve your production problem — to produce rods that have longer service life, require less shutdown time and lost production for repairs or replacements.

JoneSuckeRods LAST because Jones developed the FIRST all-metal sucker rod, FIRST streamlined forging, FIRST fully-normalizing, and Jones engineers, skilled workmen, plant facilities and superior knowledge of processing have been combined to constantly improve the design and quality of JoneSuckeRods.

METAL "FLOWS" INTO PLACE
Jones produces forgings without folds, cold shuts and other weaknesses. Metal in plastic state "flows" into place.

Illustrations show successive steps in forging JoneSuckeRods.



The S. M. Jones Co.
○ JoneSuckeRods ○

General Office and Factory, Toledo, Ohio . . . . . Sales Office, McBirney Bldg., Tulsa, Okla.

A Study of the Smackover Limestone Formation and the Reservoir Behavior of Its Oil and Condensate Pools

W. A. BRUCE, Carter Oil Co., Tulsa.

BY the first of 1943, 44 million barrels of oil and 83 billion cubic feet of gas had been withdrawn from the various oil and condensate reservoirs of the Smackover limestone of southwestern Arkansas. The original reserves of these reservoirs, as estimated by the Arkansas Oil and Gas Commission, were 342 million barrels of oil and 1,200 billion cubic feet of gas.

These pools are of particular interest for reservoir behavior study because the production and drilling has been controlled, and, in most cases, the records of reservoir data are complete.

This paper is a collection of the reservoir behavior studies for several of the pools in the Smackover limestone. In addition to the individual reservoir studies, an attempt has been made to indicate the importance of a consideration of the Smackover limestone formation as a porous continuum or a single aquifer in which the withdrawals of fluids from any pool has an important effect on the behavior of all of the pools.

The Smackover formation, for the most part of the area under consideration, is divisible into two members of which the upper consists of oolitic to chalky limestone, and the lower of dense limestone with dark argillaceous bands. The porous oolitic zone is overlain by a hard, dense limestone band ranging from 15 to 50 ft. in thickness. Below this is the Reynolds lime which consists of a porous, oolitic limestone of varying permeability. This zone is broken here and there by lenticular strata of dense lime. These strata are usually not sufficient in extent to prevent the vertical movement of fluids over any considerable area.

The Smackover limestone extends from the unconformity shown in Fig. 1, which is the limit on the north, indefinitely into Louisiana on the south. There is no known outcrop, nor is it likely that water entered or left this formation after lithification. Thus, here is a picture of an isolated body of porous, permeable limestone 100-300 ft. thick and covering from 10 to 20 thousand square miles and filled with an almost saturated brine which has been partially displaced in some of the high spots by petroleum accumulations.

The area of immediate importance to the known production is about 2 million acres and probably contains over 200 billion barrels of water. The known oil in place was 700 million barrels and the gas in place was 600 million barrels. To displace 50 per cent of these hydrocarbons by water will mean that the water in place in those parts of the aquifer away from the petroleum accumulations will have to expand more than one-third of 1 per cent. Assuming the laboratory value for the compressibility of water, this would require a reduction in pressure of about 1,000 lb. Thus, it is obvious that some or all of these pools will be in competition for water from the common supply before exploitation of these reservoirs is complete.

It is believed that sufficient evidence has been accumulated to show that all of these pools have water drives. The accumulated water influx into all of these pools by mid-1943 had amounted to 64,180,000 bbl.

A typical example of these pools is the Magnolia pool, which is the largest. The Magnolia pool is an elongated anticline with an areal extent of 5,600 acres and a closure of over 270 ft. This pool has been producing over 5 years and has produced over one-fifth of the ultimate recoverable oil. It is currently being depleted

(Continued on page 109)

TABLE 1

Pool—	Producing wells	Est. acres	Orig. res. vol., million bbl. Gas zone	Orig. res. vol., million bbl. Oil zone	Est. avg. lab. permeability md.	Est. avg. lab. porosity (per cent)
Atlanta	22	1,000	2.4	23.8	1,276	15.0
Big Creek	1	200	12.0	....	250	12.5
Buckner	28	1,610	....	43.3	50	20.0
Dorcheat	23	2,130	80.0	21.8	155	14.0
Macedonia	17	2,250	100.0	24.0	229	14.0
Magnolia	116	5,600	65.0	360.0	1,500	17.0
McKamie	17	2,800	288.6	....	400	17.0
Midway	37	2,400	....	180.0	145	21.3
Mount Holly	5	360	11.3	10.5	1,130	20.0
Schuler	15	1,200	4.7	34.4	1,500	18.5
Texarkana	1	240	5.0	....	174	14.0
Village	12	640	11.3	18.8	2,000	20.0

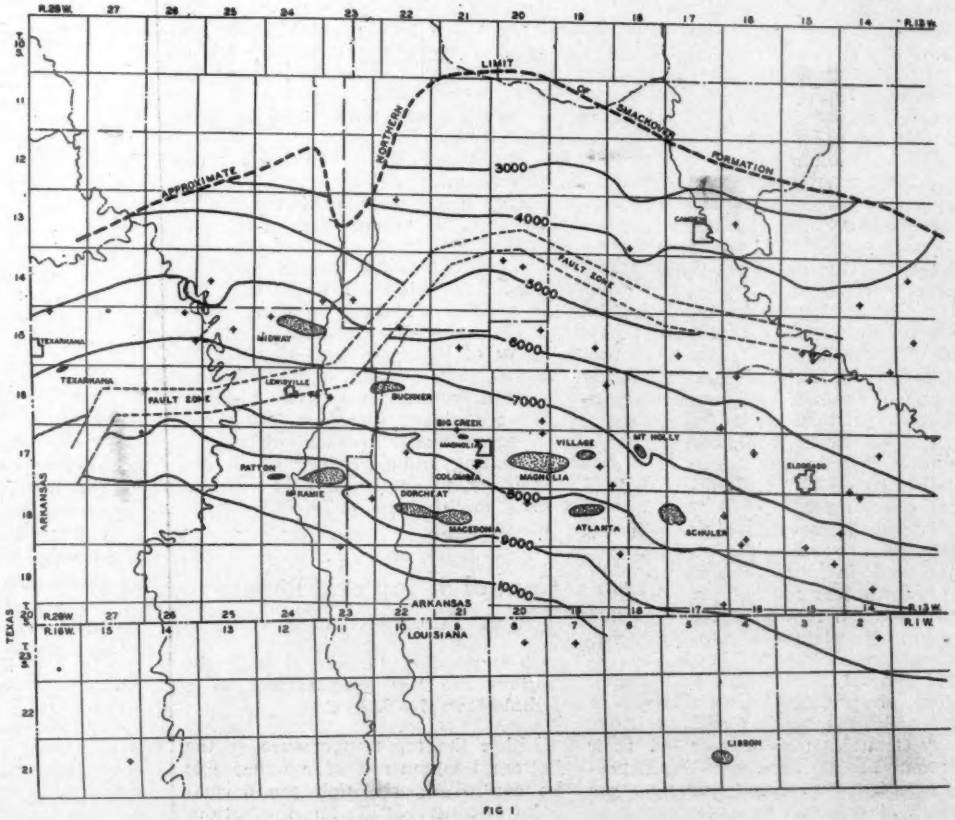


FIG 1

QUESTIONS on TECHNOLOGY

by W. L. Nelson

Quality of Butane Gases From Refineries

Is the butane made from refinery gases as satisfactory for household burners as the butane made from natural gas?—B.M.C.

The main hydrocarbons found in bottled gases are as follows:

	Mol. wt.	Lb./gal.	Heat of comb. B.t.u./lb.	Heat of comb. B.t.u./gal.
1. Propane	44	4.23	21,700	91,900
2. Propylene	42	5.07	21,050	107,000
3. Butane	58	4.85	21,300	103,000
4. Isobutane	58	4.73	21,300	101,000
5. Butylenes	56	5.2	20,800	108,000
6. Isobutylene	56	5.21	20,800	108,000
7. Pentane	72	5.25	21,150	111,000
8. Isopentane	72	5.19	21,000	109,000
9. 2,2Dimethyl propane	72	5.10	21,070	107,000
10. Pentylenes	70	5.4	20,600	111,000

The saturated or paraffin (and isoparaffin) hydrocarbons, such as numbers 1, 3, 4, 7, 8 and 9 in the above tabulation, are found in bottle gas made from natural gas. In refinery bottle gas, the unsaturated or olefin hydrocarbons designated as 2, 5, 6 and 10 in the tabulation may also be present. These unsaturated hydrocarbons are derived from high-temperature decomposition processes such as cracking. The amount of these unsaturated hydrocarbons in a refinery bottle gas would usually not amount to more than a fourth of the total. At the present time, due to the use of these hydrocarbons in making aviation gasoline, the average proportion of unsaturated hydrocarbons in refinery bottle gas or butane gas is even lower.

An inspection of the tabulation indicates the refinery bottle gas would be slightly heavier than that produced from natural gas. It would weigh perhaps 2 to 5 per cent more than a product made from natural gas. Likewise, it would have a somewhat higher heating value (on a per-gallon basis) but only about 1 to 4 per cent larger.

The unsaturated gases found in the refinery product are chemically active and in some degree unstable. This instability normally makes little difficulty; in fact none has been apparent. Nevertheless, two other hydrocarbons not shown in the tabulation, namely butadiene and pentadiene, are produced in small amounts in cracking processes and could be very troublesome because of their tendency to produce gum-like deposits. Thus, a refinery liquefied gas which is produced in large part from the gases produced in a cracking plant would probably cause plugging of feed lines, accumulations of sediments in the storage tanks, and erratic burner operation. Such a situation should be exceedingly rare because normally no refiner would prepare a liquefied petroleum gas from cracking-plant gases alone.

In one other respect the refinery products are different. They tend to smoke to a greater degree. This is not of great importance in heating-type burners but is of vital importance in lamps. The smoke point of the paraffin (and isoparaffin) hydrocarbons is high whereas the olefins have a low smoke point. More specifically, the smoke points are related to one another approximately as follows:

Paraffins are nine times as much as aromatics.

Naphthenes are three times as much as aromatics.

The smoke points of the olefins are probably nearer those of the aromatics than those of the naphthenes. The smoke point is a measure of the maximum height of flame that can be produced without smoking.

All of the above considerations are really of little practical significance. Liquefied petroleum gases, whether derived from natural gas or refinery gas, are almost identical. The refinery product will have a slightly higher heating value, slightly more of a tendency to smoke and in extreme cases might tend to produce gum-like deposits.

Control of Top and Bottom Tower Temperatures

Is it possible to control both the bottom and top temperatures of a bubble tower?—R. A. C.

Either the top temperature or the bottom temperature of a tower can be controlled. Although the normal point of control is the top, the bottom

A view of one of the many natural gasoline absorption plants designed and constructed by Petroleum Engineering, Inc., in the past 15 years of continuous service to the industry . . . in design and construction of cycling plants, repressuring plants, vapor recovery plants and pure hydrocarbon plants. *Petroleum Engineering, Inc. Offices: Tulsa, Houston.*

Photographed for Petroleum Engineering, Inc.
By Robert Yarnall Richie

temperature is usually the control point on the very common operation of stabilizing a gasoline. Selection of the control point is based primarily on which product is the main or valuable product. Thus in a topping tower the topped crude oil is a sort of catch-all in that whatever is not wanted in the overhead products becomes a part of the topped crude oil. The opposite situation exists in a gasoline stabilizer. Here the bottom or gasoline product is the desirable product and what cannot be incorporated into the gasoline is rejected into the gas or overhead product. Thus, the top temperature of a topping tower is controlled but the bottom temperature of a stabilizer is used as the control temperature of a stabilizer.

Theoretically, the bottom and top temperatures could both be controlled at the same time. Practically this is almost impossible because the two temperatures are dependent on one another and the operator has great difficulty in making simultaneous adjustments of both temperatures. If the operator is unsuccessful in keeping exactly the right pair of temperatures the tower will tend to surge and in extreme cases to purge itself by blowing its contents overhead into the condenser. Finally, it is altogether unnecessary and in fact a disadvantage to establish control at both the top and at the bottom of a tower. When one of the temperatures is controlled, the other one automatically fixes itself and the operator finds himself helpless in trying to adjust the uncontrolled temperature to anything except the correct temperature. He may, of course, employ more reflux on a stabilizer and thereby slightly reduce the top temperature, but if a great decrease in the top temperature is attempted he will succeed only in exceeding the capacity of the tower or will cause surging and finally "puking" of the tower.

A mixture of many components can be discussed only with great difficulty and hence, in an attempt to explain the facts which underlie the above statements, a consideration of two single hydrocarbons will be presented. Consider two hydrocarbons such as pentane and heptane. At atmospheric pressure, these materials boil at:

Normal pentane	97° F.
Normal heptane	209° F.

Obviously, these two materials, if completely separated from one another, will be withdrawn from a fractionating tower at 97° F. at the top (pentane) and 209° F. at the bottom (heptane). If they are not completely separated from one another the top temperature will exceed 97° F. and the bottom temperature will be less than 209° F., or in other words, the top and bottom temperatures will tend to approach one another. This may result from poor fractionation but in no case will it be possible to force the two temperatures apart by more than 209 minus 97 or 112° F. Attempts to do so will only result in exceeding the capacity of the tower to handle reflux, and surging or flooding will occur. Thus, the operator fixes one of the temperatures at some acceptable quality or purity of the product and then lets the other temperature vary, utilizing additional reflux and bottom heat up to the maximum capacity of the tower or to the maximum cooling and heating capacity of the auxiliary equipment.

With a complex or multicomponent feed the situation becomes even more complicated. Consider the same case as above except that a small amount of normal hexane, which boils at 158° F., is contained in the feed. If now the top temperature is depressed to 97° F. by reflux and the bottom temperature is held up to 209° F. by bottom heat, the hexane will have no place to go except to accumulate on the plates in the middle of the tower. It cannot go (totally) into the bottom product because it would be vaporized by the very high temperature of 209° F. and it could not pass overhead at a temperature of 97° F. because it would be returned as a liquid to the middle plates of the tower. Thus, the hexane would accumulate until the plates were full and would then of necessity blow the pentane out of the top of the tower or would surge out of the bottom of the tower. The tower could then operate again for a short time or until hexane again accumulated in the middle of the tower.

In such a system, either the top temperature would have to be increased sufficiently to allow both pentane and hexane to proceed from the top, or the bottom temperature would have to be decreased to let hexane and heptane flow from the bottom of the tower. Obviously, both temperatures could be altered so that impure products were made at both ends of the tower, but the common procedure is to make up one's mind as to which product is most important and to establish control of temperature at this product.

The exact magnitude of the temperatures and their proximity to one another is dependent not only on the composition of the feed but also on the number of fractionating plates that are available and the diameter or capacity of the tower to handle reflux. Thus a large tower with many plates would tend to permit a wide spread in temperatures between the top and bottom temperatures whereas a small tower with only a few plates would produce poorly separated products which would have boiling points (top and bottom temperatures) that are closer together.

ENSIGN
CARBURETORS
for the Toughest Jobs
IN WAR AND PEACE
ENSIGN Carburetors for Natural Gas, Butane-Propane and Gasoline are faithfully serving our Armed Forces on many of the toughest jobs that War can demand:
But ENSIGN Carburetors are also available for peaceful work. The supply is limited due to the emergency, but quick delivery of vital parts is being maintained.
In War or Peace, ENSIGN is the leader in efficient, economical carburetion.
Prepare NOW for post-war business. Our experienced carburetion engineers are at your service.
ENSIGN
CARBURETOR CO., LTD.
HUNTINGTON PARK, CALIFORNIA

TABLE 1

Pool—	Oil stock tank (bbl.)	Gas produced (M.c.f.)	Water produced	Cumulative water influx, million bbl.	Pressure change, lb. per sq. in. (Δp)	Water influx, bbl./day/ lb. per sq. in.	Water influx, bbl./Δp	Water influx, bbl./day/lb. per sq. in./acre
Atlanta	3,321,658	4,345,896	229,047	5.48	425	11.9	12,900	0.012
Big Creek	138,933	3,431,109	1,000	2.51	353	7.2	7,100	0.036
Buckner	3,853,742	913,784	453,686	4.86	710	4.0	6,800	0.003
Dorcheat	1,836,237	17,825,000	5,000	2.10	930	7.5	2,300	0.004
Macedonia	579,577	7,017,000	3,000	....	430	....	....	....
Magnolia	27,998,000	25,299,000	2,137,000	24.50	450	41.8	54,400	0.007
McKamie	1,746,883	13,148,397	....	3.34	245	17.2	13,600	0.006
Midway	2,225,258	580,803	52,363	1.84	240	18.6	7,700	0.008
Mount Holly	219,909	1,324,241	29,758	0.69	156	8.8	4,400	0.024
Schuler	4,396,000	8,377,000	2,096,000	10.15	225	45.4	45,100	0.038
Texarkana	21,995	650,000	....	0.55	69	17.4	8,200	0.073
Village	1,801,600	7,930,000	518,000	8.15	170	25.2	47,800	0.038

TABLE 3

Pool—	Arbitrarily assumed L/N	Arbitrarily assumed MN	Determined by analysis L	N	M	k b/v	cb
Atlanta	0.01	0.1	0.354	35.4	.0028	2.55	.00061
Buckner	0.01	0.1	0.1112	11.12	.0090	1.28	.00018
Midway	0.00867	0.2775	0.1781	20.2	.0137	3.45	.00031
McKamie	0.01	0.2	0.575	57.5	.0035	4.14	.00044
Magnolia	0.001496	0.06	0.1367	91.3	.0007	6.57	.00231
Mount Holly	0.02	0.3	0.493	24.65	.0122	1.78	.00021
Schuler	0.006	0.1	0.359	59.8	.0017	4.32	.00162
Average						3.44	.00058

Note: Assume b = 100 ft. and v = 1.0 c.p. then average k = 30 md. and c = 5.79 × 10^{-6} bbl./bbl./lb. per sq. in.

L, M and N are factors explained in the special report on the analyzer
k = permeability in perms (1.127 times darcys)
b = thickness in feet
v = viscosity in centipoise
c = compressibility in bbl./bbl./lb. per sq. in.

storage, it will be observed that the indicated effective compressibility of water, ignoring the compressibility of the aquifer, or other factors, is about twice that obtained by laboratory measurements.

An examination of the last three columns of Table 2 shows some interesting results obtained from the study of these reservoirs. These data tend to bear out in a qualitative way some of the theoretical principles of compressible-fluid flow. One particular thing indicated is that, in a given homogeneous aquifer, the smaller the pool the more powerful the water drive, when production rate is based on acreage or reservoir volume.

A.I.M.E. Abstracts

(Continued from page 105)

at the rate of about 4 per cent per year.

Over 25 million barrels of water have moved across the original oil-water table and it is estimated that all of the oil could be produced by natural water drive.

The behavior of this pool is very sensitive to operating conditions. Various methods of operation could lead to four distinct types of behavior: (1) A dissolved gas drive with a delayed gravity segregation would result if the rate of oil withdrawals were permitted to rise above 25,000 bbl. per day (7 per cent per year). (2) Total flushing by water, including invasion of the gas cap, which was originally one-sixth the size of the total reservoir, would result from a combination of high gas-oil ratios (2,000-3,000 cu. ft. per barrel) and moderate rates of production (10,000-20,000 bbl. per day). The end condition of this operation would be the flooding of the entire oil and gas zones by water some time after 1975. (3) A combination of gas cap expansion and water drive would result from gas injection. With the return of 100 per cent of the produced gas, the gas cap would expand from its original one-sixth to a maximum of one-third. The end point of the oil pool development would be a narrow zone of oil between gas and water. (4) A combination of gas-oil ratio control and salt water return to the Smackover could enable a control of the pool such that reasonable rates of production could be obtained and the anticipated losses by liquid invasion of the gas cap could be avoided. The end point of this operation would be similar to the one above, except that the final gas cap would be nearer the original gas-cap size.

Table 1 shows the factual data used in the analysis of the behavior of these pools. Table 2 shows the derived data, based upon a material balance. Table 3 shows the results of analysis. The last column on the right of Table 3 could be referred to as "storage capacity of the aquifer," and the column next to this could be referred to as "transmissibility of the aquifer." It will be noted that the transmissibility factors show some variation, but nothing like the variations of the porous media in individual pools. None of the transmissibility factors are more than double or much less than half of the average, whereas the permeabilities within the pools vary as much as 30 fold. It will be noted that the transmissibility factors or the effective permeabilities are much lower than laboratory determinations of permeabilities within the pools indicate. These transmissibility factors are determined for zones several miles from the pool and these data may indicate that the over-all formation is effectively less permeable in the areas between pools than it is in the oil zones.

In regard to the average factor for

BOOKS

HAND TOOLS. By Albert M. Wagner and Harlan R. Arthur. Published by D. Van Nostrand Co., Inc., New York. 174 pp., $1.75.

This useful manual is intended to serve the beginning shop worker in identifying the quantities of small tools that are used in every factory and shop. No attempt has been made to instruct in the use of these tools. A few lines of explanation, a sketch and the name are given for each tool to distinguish it from others that are similar in functions and appearance. The authors are with the Henry Ford Trade School, and the Naval Training School, respectively.

SIMPLIFIED PETROLEUM CHEMISTRY AND PHYSICS. Compiled and edited by Petroleum Educational Institute, 704 Spring St., Los Angeles, Calif. 122 pp. $3.50.

This volume contributes further to the elementary material on the subject of petroleum and its products. It collects many scattered contributions in the simplification of the subjects treated by many organizations. Simplicity has been the keynote, the illustrations and text both being of a nature as to be understood by even the most unenlightened. The entire illustrative treatment is achieved with simple sketches.

PLANT PRACTICES

Wedge for Rolling Sheets

ONE difficulty in rolling steel sheet in the customary three-roll press is that it is impossible to roll the last few inches of the sheet into the desired curvature. When crimping equipment is not available a wedge as shown in the illustration can be used to accomplish this result. The unit is a 32-in. curved wedge, flat on its long or transverse element, and curved on a 30-in. radius on its back-to-point element. It is 8 in. deep, and its thickness decreases from 1 in. at the back to ¼ in. at the front edge. The handle is welded on and used merely for ease in handling. The wedge is slipped across the two lower rolls and the sheet is rolled while passing between this wedge and the lower roll, enabling the operator to roll the sheet completely to the edge to the desired radius.

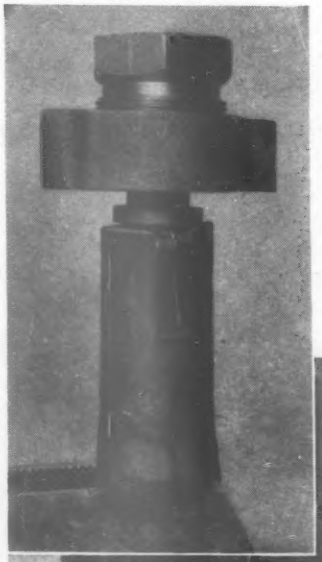
Base for Portable Pump

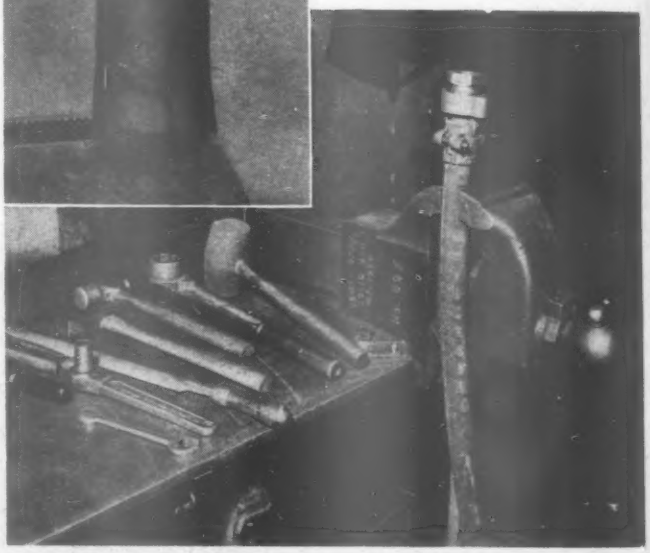
IN numerous cases a portable light pump is used around the refinery yard, either equipped with its own driving motor and extension cord or for coupling to any rotating shaft or electric motor. Here is a simple method of rigidly and compactly mounting such a pump. Pump's base is bolted directly to a heavy 2½-in. thick timber of required width and length, as 18-in. by 30-in. At each end a heavy steel strap is fitted to the timber, with 2 in. of each end bent at right angles to fit tightly along the opposite edges of the wood, and screws set through a hole in the metal tightly into the wood. Or, a ¼-in. hole may be drilled entirely through the timber, edgewise and a long bolt passed through strap ends and wood, reinforcing the ends of the base. On each side of the assembly at about the center of gravity a handle may be fitted. These handles are made by bending a section of pipe, ½ in. to 1 in. in diameter, at practically right angles, bending and flattening

the lower ends of these handles, drilling two or more holes through these flattened ends, and screwing or bolting them to the base. The flattened ends must be bent at such angle that the handle portion will be accessible for carrying the assembly and so that the handles will be parallel to the base and to each other. In the case of a motor being included in the assembly the procedure is identical with that described.

Grounding Steam Hose

A SIMPLE method of grounding a steam hose which will eliminate the building up of charges of static electricity on the discharge end of the hose is to insert a wire inside of the hose and fasten it to the couplings on both ends of the hose. The illustrations show the method of fastening this ground wire to the coupling. A V-shaped copper strip is placed over the end of the hose and the ground wire bent over this strip. The connector nipple is then driven into the hose as shown. A two-piece clamp with extension right-angled lugs on opposite sides of the shoulder of the nipple is then fitted over the copper sheet, and the ground wire and its closing bolts drawn down tightly. The lugs on the clamp are bent down toward the nipple so that they catch the nipple collar or shoulder preventing the nipple from being forced out of hose.





Two variations of an idea to facilitate the handling of large, heavy cylinders

Cradles for Large Cylinders

FOR arranging a type of support or "cradle" for large cylinders such as tanks, drums, heat exchangers, etc., it can be difficult to provide adequate and strong enough equipment without too great expense. One method is as follows:

Two or more steel I-beams are provided and the top flange of each is drilled at convenient intervals, as 6 in., with double holes of a size necessary to admit the bolts employed. These I-beams can be of any required size, the larger ones for the heavier work. For example, beams used to handle tanks of up to 20 ft. or more diameter are 8 in. by 10 in., and 8 to 12 ft. long.

The rollers mounted on axles and bases—dollies—are provided for each I-beam. The horizontal portion of the dolly bases are drilled for bolts of the needed size, say ½ in., two bolts are provided for each dolly and the roller dollies are bolted down on the I-beam at the required distance apart, with their axles parallel. The I-beams are placed parallel at the requisite distance apart and the cylinder, tank or other equipment is hoisted into place, resting on the rollers. This arrangement, for example, enables a tank to be turned on its axis when welding seams, speeding up the operation remarkably.

In a variation of this idea a pair of roller or dolly assemblies, each of which has two rollers fitted to an extended base, are bolted together by means of a heavy steel strap at the distance required to support a cylinder or tank of a given diameter. In the case of a situation where regular work is carried out on tanks of a given size, the tie strap may be welded to the dollies. This arrangement is shown at right above.

Heavy Angle-Bending Attachment

FOR making heavy sheet bends a special attachment die has been worked out by the boiler shop staff of Standard of Indiana's Whiting refinery, utilizing the sheet-rolling press as support and power-applying means. The lower or female half of the die is a 10-ft. 6-in. V-bar, the base of which is a 4-in. by 14-in. by ½in. angle iron. Triangular plates are welded to the under side of this base at right angles with the apex of the triangles downward; they are placed at 8-10-in. intervals and these triangular pieces support the V-bar in a horizontal position in the angle between the two lower rollers of the press. The male die is a 6-in. wide piece of ¼-in. plate bolted between two 6-in. by 4-in. by ½-in. angle irons. To the back of this die are fitted two or more circular straps and the die is fitted in place by placing it against the lower edge of the upper roll, lowering the roll until the male die fits into the V of the female die, and then tightening the straps around the upper roll. Sheets may be bent at any required angle by placing the sheet across the V along the desired line, and lowering the upper roll until the male die forces the sheet down into the V as required.

The rack is built on a 3-ft. flat base, drilled and tapped in the center to receive a threaded 3-in. pipe about 3 ft. long. Into this 3-in. pipe a section of 2-in. pipe 4 ft. or longer, as desired, is inserted. This pipe is drilled diametrically through both sides for the insertion of stop pegs. A horizontal crossbar is fitted to the top of this 2-in. pipe, the bar being made up of two parallel steel strips with spacer setting the strips about 2 in. apart and with small pulleys fitted at each end between the strips and at the midpoint. A ⅜-in. cable is passed through the pulley at the center, is dropped down through the 2-in. pipe and is fastened to a weight which rides up and down in the 3-in. pipe below. This cable passes around the pulley at one end of the horizontal crossbar, back along and above the bar, over the pulley at the opposite end and terminates in a snap or hook which is fastened to a loop or other suitable appurtenance on the rolling-in motor. The 2-in. pipe may be set at different heights by changing the location of the stop peg through the holes. A flanged sleeve riding on top of the 3in. pipe base is the stop against which this peg rests to support the upper pipe.

Bending attachment for making heavy sheet in a refinery

There is No Substitute for Experience

ONLY by actually building a model ship can a boy get the experience and knowledge of the old sailor—to appreciate the qualities and performance of good materials. Similarly, only by the same method—*actual use*—can you learn to recognize the qualities of Hycar synthetic rubbers—the very qualities you want in resilient materials.

Hycar is a versatile synthetic rubber—completely resistant to petroleum products of all kinds. It has an operating range from −65° to +250° F. and an abrasion resistance 50% greater than natural rubber. Unlike many other resilient materials, Hycar has a minimum tendency to cold flow after taking the initial deformation, even at elevated temperatures. And it can be tailored to fit the job because oil-swell can be held to ±1%, or even to zero.

Here are just the qualities you want for oil and gasoline hose, gaskets, seals, packing, pipeline scrapers, protectors, vibration dampeners, diaphragms, valves and all other resilient products used in the oil industry.

Learn by actual experience by asking your supplier to furnish experimental parts made for tests in your own applications. Experience you gain now will reduce operating costs later. *Hycar Chemical Co., Akron 8, Ohio.*

Hycar

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubber

SALT-WATER DISPOSAL COSTS

SALT - WATER - DISPOSAL operations have become increasingly important each year in the activities of producing oil companies. Where in former years, the disposal of salt water was a problem which was oftentimes overlooked or ignored, the ever-present liability of expensive lawsuits has resulted in major salt-water-disposal installations on the part of the operator. In most instances this phase of the oil business is covered by strict laws, promulgated by the various state governments.

The subsurface injection of all salt water into underground formations below the sources of fresh-water supply, is necessary in many areas. Naturally, such installations have resulted in major investments and as such, require a thorough analysis of the costs involved.

Various accounting procedures are used for handling these costs, but eventually the expense is charged back to the leases connected to the salt-water system. Unlike many other types of installations, the life of the disposal system involves a great many uncertainties and the depreciation rates as shown on the accounting records may be quite high. Some operators prepare monthly statments showing a breakdown of salt-water costs. The expense may be charged against all producing oil wells connected into the system, either on a flat per-well basis or on some arbitrary prorated basis.

Due to the necessities of accounting procedure and the correct distribution of charges on a more or less current basis, these records may afford very little information to the cost engineer who is interested either in projecting these costs into future operations or in comparing the costs with similar operations in other localities.

The major portion of this expense may consist of fixed charges and does not necessarily depend upon the number of producing oil wells connected to the system, the amount of oil produced, or the volume of water handled.

On the other hand, it is advantageous to know something about future salt-water-disposal costs at the time the producing properties are being developed. Of necessity, such estimates must be based on the size of the system to be installed, and both the maximum and total amount of water to be handled, together with some idea as to the productive life of the oil field. Fortunately, salt-water systems usually can be designed with a great degree of flexibility, which offsets to some extent the major uncertainties involved.

During the early period of operation of the salt-water system, the cost per barrel of salt water handled is relatively high due to the small volume of water production. As an example, the operating costs for a typical salt-water-disposal system in the Western Kansas area was reported to be 3.6 cents per barrel of salt water. The volume of water handled amounted to only 65,000 bbl. per month, however, and an estimate of future water production indicated that the ultimate costs would be less than 1 cent per barrel.

The future water production was calculated by means of decline curves similar to those shown in Fig. 1. For a given period the amount of water production is:

$$W = \frac{(e^{kr} - e^{ks})}{k} - (r - s)$$

Where:

W = total water production for the period in barrels

r = cumulative oil production (from time of first water) at the end of the period

s = cumulative oil production (from time of first water) at the beginning of the period

$$k = 2.303 \frac{(\log_{10} y_2 - \log_{10} y_1)}{x_2 - x_1}$$

e = 2.7183

x_1, y_1 and x_2, y_2 are any two points on the straight-line decline curve

The values of "k" where the oil production declines from 100 to 1 per cent of the total fluid vs. cumulative oil after the first water production is shown for each curve. Using an economic limit of 2 per cent oil in total fluid, the total water production for each of the curves is shown in Table 1.

TABLE 1

Cum. oil from 100% to 2% —bbl.	Value of "k"	Cum. water prod.—bbl.
8,500	.00046	99,100
17,000	.00023	198,000
25,500	.000153	297,500
34,000	.000115	396,000
42,500	.000092	494,500
50,500	.0000766	594,500
59,500	.0000657	694,500
67,500	.0000575	793,500

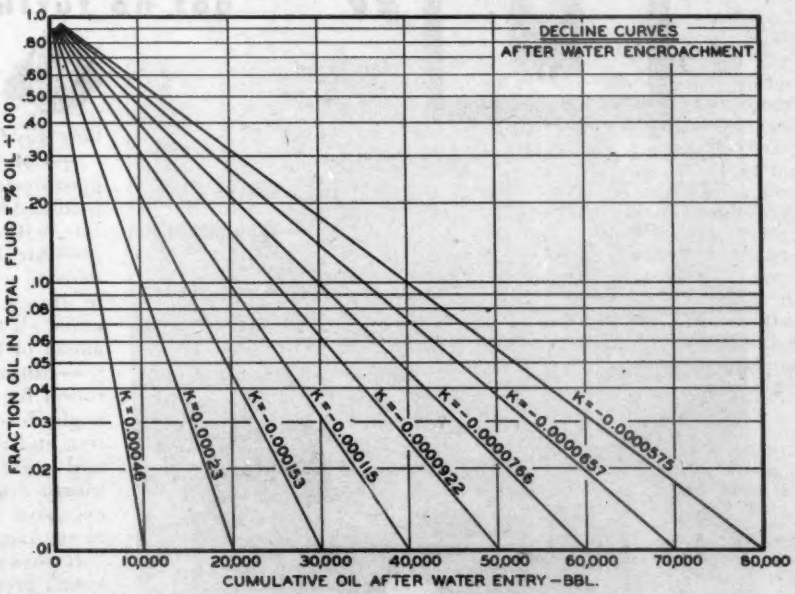


Fig. 1

STANDARD OF THE OIL FIELDS

Gotkool

WATER CANS & COOLERS

GOTT Water Cans are the practical way to keep drinking water cool for long periods, protected from impurities and always handy to the job. Snug fitting large removable top, strongly built to withstand rough usage. GOTT Water Coolers have extra large covers and a handy non-leaking push button faucet. Your Supply Store has them, get one today! . . . . .

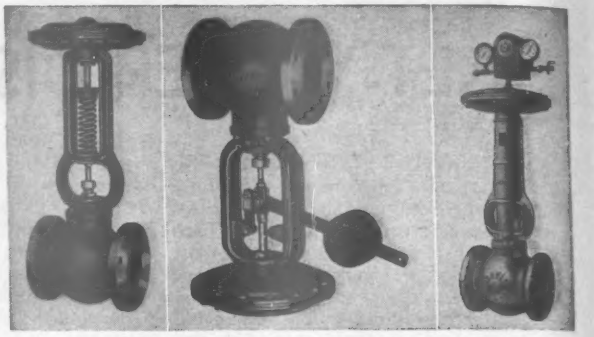
H. P. GOTT MFG. CO.
WINFIELD, KANSAS

KEEP PURE DRINKING WATER ALWAYS HANDY

INSIST ON THE GENUINE

Look for the Blue and Black Label with the name GOTKOOL in Red.

NO JOB FOR PRESSURE REGULATORS THAT CAN'T BE HANDLED BY DAVIS



No. 14 *(left) Davis Spring-Loaded Regulator*
No. 18 *(center) Davis Balanced Diaphragm-Type Regulator*
No. 401 *(right) Davis Pilot-Operated Regulator*

STANDARD Davis Pressure Regulators are available to meet virtually any requirements. Some models are spring-loaded, others weight-loaded, depending upon which best serves the valve design and application. Because operating conditions vary so greatly, careful selection of the right regulator for the job is of extreme importance. his job, however, is greatly simplified when you specify Davis, for there are eighteen different types to choose from—sizes up to 24"—for pressures up to 1500 lbs. And—Davis provides experienced engineering cooperation, informative literature and a handy "Service Selector Chart" to aid you. Write today.

DAVIS REGULATOR COMPANY
2543 SOUTH WASHTENAW AVE., CHICAGO, ILL.

DISTRIBUTOR: Westcott & Greis, Inc., Tulsa, Dallas and Houston.

IF BUNA-S RUBBER

got no further than Butadiene

It's a long way from C_4H_6 to Buna-S synthetic rubber. Similarly, a trapping device that only removes condensate is a long way from giving complete trapping satisfaction.

—**Condensate drainage:** Some devices provide poor drainage at heavy loads, or lose steam on light loads. Armstrong traps discharge all the condensate, without steam loss, at any load.

—**Air Elimination:** Some devices handle condensate without steam loss, but have little ability to draw air out of a steam system. Armstrongs remove all the air that comes to them, whether it is ahead of the condensate or mixed with steam.

—**Maintenance:** Armstrong traps have a reputation for long periods of efficient operation with negligible maintenance. The inverted bucket design and patented free-floating valve handle sludge and scale ordinarily present in steam lines and insure freedom from sticking, wire-drawing and excessive wear. You seldom see a strainer ahead of an Armstrong trap.

It pays to have Armstrongs. Write for the Armstrong Steam Trap Book.

ARMSTRONG MACHINE WORKS
868 Maple Street • Three Rivers, Michigan

Engineering Fundamentals

No. 126

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

MEASURING FILTRATION PROPERTIES

EVALUATION of the wall-building property of a mud consists of exposing the mud to a standard filtering medium of known area at a controlled pressure and temperature for a given length of time, observing the volume of filtrate as a function of time, and measuring the thickness of the filter cake formed on the surface of the medium. Tests have been made at temperatures ranging from 60° to 250° F. and at pressures ranging from 25 to 8,000 lb. per sq. in.[1] Apparatus used in much of this testing has been so elaborate and expensive as to be unsuitable for field use. Data obtained over a wide range of temperatures and pressures with various filtering media have nevertheless resulted in great advances in the knowledge of mud properties and have made possible a more intelligent application of the simple type of wall-building tester now commonly used for testing in both field and laboratory.

The wall-building tester, shown in Fig. 1*, is a filter press in which a mud sample may be subjected to a controlled pressure for a given period of time, from which the filtrate may be received and measured, and from which the filter cake may be removed for determination of its thickness and study of its properties. The filter press consists of a mud cell assembly mounted on a suitable screw press frame. Referring to Fig. 1, the mud cell assembly is composed of a mud cylinder C†, fitted with a removable cap A, a gasket D, filter paper E, screen F, and bottom plate G. The removable cap is provided with a pressure inlet connection B. When the cell is assembled, the filter rests on the screen and an outlet in the bottom plate below the filter paper allows recovery of the filtrate in a graduated cylinder J. The mud cell is mounted in the frame and held together by compression between the screw I and the cross-member H.

In assembling the apparatus preparatory to making a test the following procedure should be followed:

1. Place a sheet of Whatman No. 50 or 52 filter paper over the screen resting on the bottom plate which in turn rests on the cross member of the frame.

2. Wet the screen, filter paper, and bottom plate with water and shake gently to remove any excess.

3. Place the rubber gasket and mud cylinder on the filter paper.

4. Holding a slight pressure downward on the cylinder to prevent leakage, pour about 600 cc. of mud into the cylinder.

5. Place the cap (with rubber gasket) on top of the cylinder, and compress the cell tightly together by turning the screw handle.

6. Place a 100-cc. graduated cylinder on the support K to receive the filtrate from the drain tube.

7. Apply, through the pressure inlet B, a constant pressure of 100 lb. per sq. in.

Compressed air is commonly used as the pressure medium. In a laboratory, it may be available from a volume tank supplied by a compressor. For field tests, or in laboratories not provided with compressors, a cylinder containing air or other suitable compressed gas and equipped with a pressure regulator and control valves is used extensively. The cylinder can be periodically refilled as necessary. A special air-pressure pump with a selfcontained reservoir, pressure regulator, and control valves is available for use with the wall-building tester. This pump is used where it is inconvenient or undesirable to use the air cylinder.

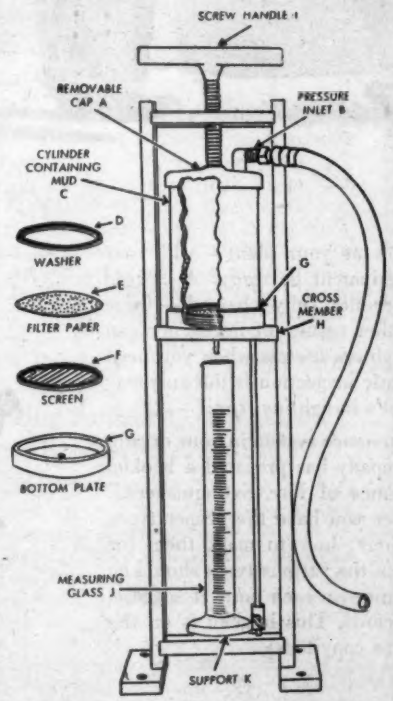


Fig. 1

When pressure is applied to the mud in the tester, a stop watch is started or the time noted on a regular watch. Common practice is to record the volume of filtrate in the graduate (measured in cc.) at the end of 5 minutes, 10 minutes, 15 minutes, and 30 minutes. Although 30 minutes is the standard length of test recommended by the A.P.I., there is variation among operators on this point. Some use 15 minutes, others use 30 minutes, while still others use 1 hour or even longer. The 30-minute testing period predominates.

At the end of the testing period, the pressure is released through a bleed-off valve on the pressure inlet line after closing the valve between the bleed-off connection and the air supply. The mud cylinder and the bottom plate are then removed intact from the press frame and the excess mud fluid poured out. The bottom plate is next carefully separated from the mud cylinder. The filter paper holding the cake is then removed from the bottom plate and washed with a gentle stream of water to remove the unfiltered mud. The thickness of the cake is then measured and reported in thirty-seconds of an inch. This measurement can best be obtained by cutting the cake in half, separating the two pieces, and measuring the thickness at the center of the cake where it has not been rounded by the washing water.

A good filter cake is thin, tough, and of a gelatinous texture. A poor filter cake is not only thicker but is more easily broken by bending the filter paper. The primary criterion by which the mud is judged, however, is twofold, viz., volume of filtrate and thickness of filter cake.

*Courtesy Baroid Sales Department, National Lead Co. †A.P.I. standard dimension for the cylinder are: Internal diameter of 3 in. (plus or minus 0.07 in.) and height 5 in. (plus or minus 0.25 in.)

References

1. Baroid Sales Department, National Lead Co., "Methods of Determining the Filtration Characteristics of Drilling Muds," Drilling Mud, Vol. 6, No. 1, May 1938.

2. A.P.I. Code No. 29, Second Edition, July 1942, "Recommended Practice on Standard Field Procedure for Testing Drilling Fluids (Tentative)".

Series prepared by Glenn M. Stearns, associate professor of petroleum engineering, University of Oklahoma

NEW FREE BOOK tells how to keep fire-fighting equipment in shape

When fire strikes at your plant — will your extinguishing equipment be *ready?* A clogged nozzle, a cylinder not fully charged — these and dozens of other results of negligence can make your fire-fighters useless when you need them most. Regular, systematic inspection is the only way to make sure your equipment's in fighting trim.

To help you set up a maintenance system in your organization, Walter Kidde & Company has prepared a booklet —"Inspection and Maintenance of Fire Extinguishers." It tells how to check whether you have the proper types and quantities of extinguishers; how to mark them for quick identification; how often the various types should be inspected; what parts to examine on each unit. It suggests simple forms for keeping records. This booklet is on the press now. Write for your free copy today.

WALTER KIDDE & COMPANY, INC., 239 MAIN STREET, BELLEVILLE, N. J.

REFINING

House Votes Funds to Build Synthetic-Gasoline Plants

WASHINGTON, D. C.—By a vote of 140 to 13 the House last week approved legislation which empowers the Government to construct and operate three experimental plants for production of gasoline from coal, shale, and other substances. Passage followed the reading of a letter from Harold L. Ickes, petroleum administrator, saying that leaders in the Army and Navy advocate immediate adoption of a synthetic-fuel program.

Rep. Jennings Randolph, sponsor of the bill, said the plants would cost about $30,000,000 and that 3 to 4 years would be required to get them in operation. They are not designed primarily as war plants.

Before sending the measure to the Senate, the House adopted restrictive amendments permitting the secretary of the interior to dispose of land or property used "subject to the approval of Congress."

Standard of Indiana Guards At Whiting Win Awards

WHITING, Ind.—The first superior plant guard guidon to be awarded to Army auxiliary military police in an oil refinery of the Chicago area was presented February 18 to the 116 guards of the Whiting plant of Standard Oil Co. of Indiana for outstanding achievement in plant protection.

Col. C. J. Otjen, commander of the Illinois and northeastern Indiana district of the Sixth Service Command for the U. S. Army, presented the guidon, which was accepted in behalf of the guards by Dr. M. R. Schmidt, general superintendent of the Whiting refinery. Capt. Ross L. Stockman, of the Army, supervisor of training for the district, presented a certificate of accomplishment to each guard. S. A. Montgomery, refinery manager, was chairman of the program.

Caddo County Refining Co. Processing Cement Crude

Caddo County Refining Co.'s plant near the Cement townsite in the Cement field, Caddo County, Oklahoma, is the latest plant added to the operating list in that state.

Constructed several years ago and operated as the Cement Refining Co., the plant recently was taken over to handle low gravity crude from the Cement field. With a possible capacity of 1,000 bbl. daily, the plant is running 800 bbl. of the 18-gravity oil from the Ohio Oil Co.'s Kla-daing lease.

The plant is processing the crude for fuel oil, with a net yield of this production of around 90 per cent. The remaining lighter products are fed back into the crude-oil stream of the Anderson-Prichard Oil Co. and sent to the latter's plant at Cyril, Okla.

The Caddo County Refining Co. is headed by J. Steve Anderson, Jr., and is composed of officials and employes of the Anderson-Prichard company.

Cooperative Plant Facilities Dedicated

COFFEYVILLE, Kans. — Refining facilities here which were purchased January 1 from National Refining Co. by Consumers Cooperative Association, North Kansas City, Mo., were dedicated "to the service of the people" February 19 by Ralph Snyder, president of the Wichita Bank for Cooperatives. Attending the ceremony were directors of the association, its executives and fieldmen, and invited guests.

A gasoline refinery with an output of 81,000,000 gal. of refined fuels annually, and a lubricating oil refinery with an output of 11,000,000 gal. of oil a year, were the two plants dedicated. The association will operate also the government-built aviation plant here to supply high-octane gasoline for the air force.

Wider Authority Conferred On Director of Refining

WASHINGTON, D. C. — Authority vested in the director of refining, Petroleum Administration for War, is substantially widened by an executive order issued by Ralph K. Davies, petroleum administrator. Among other things, the order confers upon the director of refining authority to issue such instructions to refiners as are, in his judgment, required to achieve objectives of approved PAW operating programs, including the amount of crude oil to be run at refineries, the amount of various pe-

TOWER PACKING

- Raschig Rings
- White Porcelain Rings
- Chemical Stoneware Rings
- Carbon Rings
- "Cyclohelix" Single, Double, or Triple Spiral Packing Rings
- "Hexahelix Spiral Packing
- Cones, Grid Tile, Ceramic Balls

All Products of U. S. Stoneware.

Better Deliveries too! Send For Bulletin 51

Phone 3-8659, Tulsa

THE EDWARD SOPH CO.
TULSA OKLAHOMA
CORROSION RESISTING EQUIPMENT

troleum products to be manufactured by specific refiners, and the quality of such petroleum products; to deny or grant certain applications for exceptions or appeals filed pursuant to the orders or directives; to establish and issue minimum specifications for petroleum products, but no such specifications shall be established except after consultation with the directors of marketing and petroleum supply, Washington, and the district directors in charge of Districts 1, 2 and 3.

Cooperatives Decide to Buy First Texas Refinery

AMARILLO, Tex. — Purchase of a $2,000,000 refinery to serve farmer cooperatives in Texas, Oklahoma, Colorado, and New Mexico was decided upon by Consumers Cooperative Association, holding its annual meeting here last week. Delegates from 65 local cooperatives in the four states were present. Local associations and individuals pledged $125,500 toward the purchase price. Nine refineries are owned by cooperatives in the West and Middle West, but this will be the first one in Texas.

Howard A. Cowden, North Kansas City, Mo., president of Consumers Cooperative Association, which owns three refineries and has an interest in a fourth, told the meeting that "56 corporations have obtained 75 per cent of the (nation's) war contracts and 300,000 small business men have been forced out of business since Pearl Harbor."

Sketches of Plant Operators

MILES COWDEN, superintendent of the Scottsbluff, Neb., plant of Cooperative Refinery Association, grew big and husky while working with his brothers on the reluctant soil of a farm in the hill country of Missouri, his native state. His introduction to the cooperative movement was in November 1929, when he began operating a retail service station. This work wasn't a succession of roseate days, of course, but farm life hadn't been either. Besides, he had an eye to the future.

So in February 1930, the embryo oil man found himself superintendent of the lubricating-oil plant purchased by Consumers Cooperative Association in North Kansas City, Mo. The refinery association is a subsidiary of CCA. Cowden kept this position until August 1939, when CRA built its first unit, the 3,400-bbl. plant at Phillipsburg, Kans. He served as assistant superintendent there until December 1941, when he was promoted to superintendent of the 1,500-bbl. refinery at Scottsbluff, which CRA bought at that time from Terry Carpenter.

Both refineries have complete topping and cracking units.

HE WORKS BETTER . . .
AND SAFER
The Justrite Twin-Bulb Safety Lantern transforms the darkest nights to day wherever brilliant light is required. Easily carried by swinging handle. Movable steel guard serves as stand for lantern. Approved by Underwriters' Laboratories, Inc. for safe use in Class 1, Group D locations.
See your jobber for details and prices.
JUSTRITE MANUFACTURING COMPANY
2061 N. Southport Ave., Chicago, Ill.
The Justrite Twin-Bulb Safety Lantern provides powerful 634 candlepower beam. Twin bulbs guard against hazards of light failure. Rugged construction . . . can take hard knocks.
JUSTRITE Safety Products
SAFETY CANS · FILLING CANS OILY WASTE CANS
APPROVED SAFETY ELECTRIC LANTERNS

PIPE LINES

Hugoton Outlet to Be Completed April 1

Completion of Cities Service Transportation & Chemical Co.'s 26-in. pipe line connecting eastern Kansas with the Hugoton natural-gas field of western Kansas and Oklahoma is not expected by officials of the Gas Service Co. until April 1.

Fred Karr, company manager, said the original completion date was February 1 but that bad weather had delayed construction of the $11,000,000 line which will connect with Cities Service Gas Co. facilities at Blackwell, Okla.

McCORD
Class S.F.
LUBRICATORS
A modern lubricator for modern service on Diesel, gas, steam engines and compressors. Supplies dependable cylinder lubrication in metered quantities reducing friction and wear. Capacities: 2 to 24 pt. and 1 to 16 feeds. New catalog on request.
RESULT OF 40 YEARS' LUBRICATOR BUILDING EXPERIENCE
McCORD
RADIATOR & MFG. CO.
DETROIT, MICHIGAN
LUBRICATOR DIVISION

WEP Products Stream Reaches Pennsylvania

The head of the products stream passing through the 20-in. line of War Emergency Pipelines, Inc., arrived at Station 20 near Waynesburg, Pa., early this week.

Some trouble was experienced between Stations 19 and 20 requiring the elimination of a temporary obstruction which slowed progress. This may have been due to the sticking of a "pig" or air binding. No trouble has been caused by clogging due to ice.

During the pumping east from Norris City, Ill., there have been no breaks in the line. Overflow from a sump pit had given rise to false reports of a break. Arrival of products at Linden, N. J., is expected at the end of the month.

Big-Inch Pumped 88,000,000 Bbl.

More than 88,000,000 bbl. of crude oil were delivered from Texas to the East Coast last year by the 24-in. pipe line, Petroleum Administrator for War Harold L. Ickes announced as the second year of operations began February 19.

"That is equivalent," Ickes said, "to the quantity that could be hauled by a fleet of 18,000 tank cars operating in Gulf Coast-East Coast service on a 7-day week with no layovers."

Final Joint of Canol Project Is Welded

Final links in the American financed Canol project pipe line from Norman Wells, N. W. T., to Whitehorse, Yukon, were welded last week near Macmillan Pass astride the Arctic Continental Divide in the MacKenzie Mountain Range.

FOR TRADE:

Buckeye 12, ditching machine, good condition, to trade for Buckeye 36 or larger.

United Contracting Co.

Box 2451 Phone 22270

Wichita Falls, Texas

CRC

PIPE LINE CONSTRUCTION EQUIPMENT

CRUTCHER-ROLFS-CUMMINGS
Pipe Line Equipment and Materials
Houston, Texas, U. S. A.

14,500 MILES
Pipe Lines With
PRICE-WELDED Joints
"The Modern Method"

An organization operating wherever Oil, Gas and Water Lines are constructed.

H. C. PRICE CO.
ELECTRIC WELDING CONTRACTORS AND PIPE LINE CONTRACTORS
BARTLESVILLE, OKLA.
Los Angeles San Francisco

The welding completed one of the most vital parts of the $130,000,000 project, a program of the U. S. Government for development and distribution of oil and gasoline in northwestern Canada and Alaska.

Bayou System Pumps Daily Average of 63,500 Bbl.

HOUSTON, Tex.—The Bayou Pipe Line System, 300 miles of products pipe line extending from Houston and Texas City, Tex., to Baton Rouge, La., on February 15 completed a year of service to the nation's war effort, H. H. Anderson, vice president of the Shell Pipe Line Corp., announced here last week.

The Bayou Pipe Line is a products line, carrying three products (premium and housebrand gasoline and kerosene) of six companies: Humble, Texas, Shell, Pan-American, Pure and Crown Central. It replaces tankers and barges in feeding the Baton Rouge terminals of the Plantation Pipe Line Co., making possible a continuous stream of oil products from Texas City to Richmand, Va., a distance of 1,262 miles.

Engineers designed the line to deliver an average of 57,000 bbl. a day.

The highest day's throughput was 66,475 bbl. to Baton Rouge, La., through the 10-in. line and 43,187 bbl. through the 8-in. line to Port Neches, Tex., through the 8-in. line.

During the first 12 months of operation Bayou Pipe Line pumped a total of 20,382,206 bbl. at an average of 56,000 bbl. daily. The total loss including that from one major line break and two or three small ones amounted to only 0.029 per cent of throughput. The average interbatch contamination involving degrading of premium brand to housebrand gasoline and upgrading of kerosene to housebrand gasoline has been 0.3 per cent.

After the arrival of filter tanks, mechanical trouble was much reduced. Capacity has been increased by modifying the pump impellers. "Skip" inhibitor has been used continuously which loosens scale which is later removed by regular running of scrapers; as a result, line friction has been reduced and larger capacity has been achieved for the line which was constructed of pipe salvaged from crude-oil lines. Before the line was put in transportation service it was cleaned by pumping heating oil but this product has not been shipped commercially.

Stanolind Uses Portable Type Line for Gathering

Light-weight pipe joined with bolted couplings is being employed by Stanolind Pipe Line Co. for gathering line service. This type of construction is the same as that used by the Army for portable pipe lines in the battle zones of Italy.

Stanolind has two lines of this kind, the longest of which was laid recently in the Illinois Bend pool, Montague County, Texas. This consists of 4 miles of 4-in. (4.3 lb. per ft.) spiral welded pipe which was also used for a 2-mile line for the same purpose in Kansas. For several years the company has experimented with construction of this kind, but this is the first time that it has been adopted as routine procedure. The pipe is laid on the surface not as a temporary line but for continued service for handling production in the area. In the laying of lines just referred to no bending was done. This type of construction is said to be advantageous across rough ground and pasture land.

Magnolia Fills Most of Midland-Corsicana Line

The new 335-mile 12-in. pipe line of Magnolia Pipe Line Co. will go into operation March 1, from Midland, in the West Texas Permian basin, to Corsicana, in East Central Texas, where it connects with carriers running north and south, the company has announced. It will have a daily capacity of 42,000 bbl. A total of 302 miles of the line has been filled with oil from Midland to Leon, and that portion of the line has been tested and found satisfactory for service.

Pipe-Line Extensions Considered for Colombia

Cia. de Petroleo Shell de Colombia (Shell Petroleum Co., Inc.) has developed a potential of about 8,000 bbl. per day production which the company hopes to begin moving out of the country for export via the Andian National Pipe Line Co. which has its initial terminal just across the Magdalena River from Shell's Casabe Concession. Drilling is progressing at Casabe and by the end of 1944, operators expect to have about 15,000 bbl. daily production for export. This will require an elaborate gathering system through the 4,000-acre Casabe field and a difficult crossing of the Magdalena River. It may also involve some enlargement of Andian pipe-line capacity.

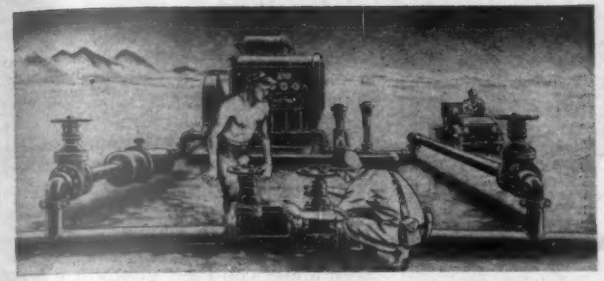
The South American Gulf Oil Co.'s Barco pipe line now moves oil only from the Petroleo field in the south-central part of the Barco Concession and are averaging about 11,500 bbl. daily at this time which is about half of its rated capacity. The new Tres Bocas-Socuavo production, about 18 miles north of Petroleo, must be tied into the pipe line for export as soon as material is available. Production here now amounts to about 7,000 bbl. daily.

Also, in the Rio de Oro field to the extreme north of the Barco Concession, about 1,000 bbl. per day production has been developed but has not been moved because pipe-line facilities are not available to connect with the main intake terminal of the Barco line. Rio de Oro production can be tied into the Tres Bocas-Socuavo line when that field is connected with the main system.

I. C. LITTLE
1608 MERCANTILE BANK BLDG.
DALLAS, TEXAS
Central Warehouse: Valley Park, Missouri

CONTRACTOR

Having constructed many hundreds of miles of oil and natural gas connecting lines during the past years, the I. C. Little organization prides itself on the *thoroughness* of its work. Rainy seasons, snow and zero temperatures; swamps, rivers, precipitous mountains—all have been encountered and overcome in the laying of these lines. In one instance, over 17,500 feet of continuous lines were *pushed* through cypress swampland—where machinery was useless—and ditching was done by blasting.



Hanlon-Waters Portable Pipe Line in use by the Armed Forces.

HANLON-WATERS
Automatic Control Equipment
IS SERVING ON THE

Fighting AND *Working* FRONTS

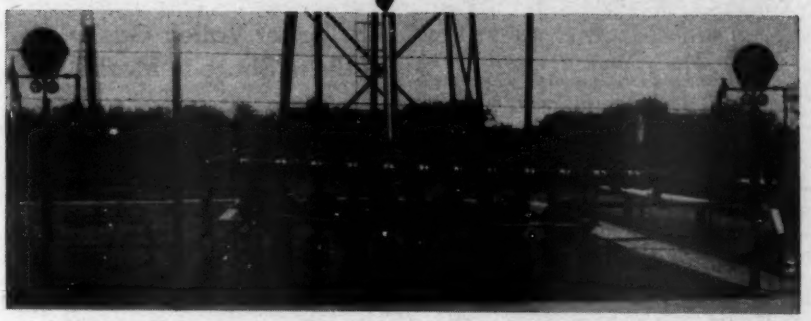
H-W Control Equipment on portable pipe line pumping units are in action aiding materially in keeping airplanes, tanks and other motorized equipment operating in battle zones around the world. Here at home and in Industry of many lands, H-W Equipment, long the Standard for Performance in the Refining, Chemical, Synthetic, Gasoline, Recycling and Power Industries is your assurance of dependable, trouble-free service. There are HANLON-WATERS Controls to meet every requirement, either standard or special designed, and for plants using highly corrosive liquids, special equipment is available. Information on the H-W Equipment to meet YOUR Control Requirements will be supplied promptly.

See 1943 Issue
REFINERY CATALOG
Pages 275-277

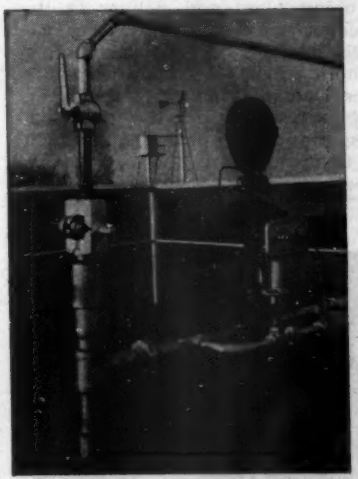
H-W Time Cycle Control Installations

Illustrated are various types of well flowing hook-ups utilizing H-W Type 980 and Type 985 Time Cycle Controllers with H-W Type 86 Motor Valves and H-W Auxiliary Equipment.

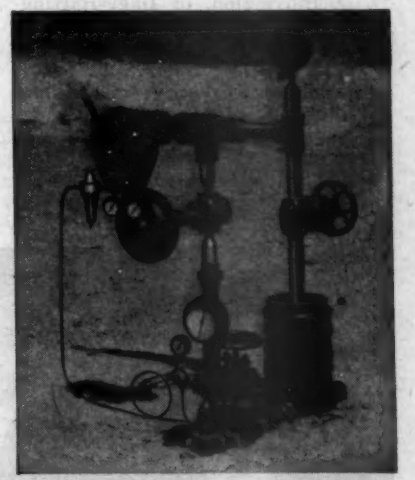
Information on all HANLON-WATERS Equipment is available at representative nearest you.



Multiple well flowing using two H-W Type 980 Controls to actuate Motor Valves opening wells on common cycles.



Intermittent gas injections to lift oil in double tubing string—prevents pressure on sand or formation. H-W Type 985 Controller with H-W Type 86 Motor Valves and H-W Type 903 Auxiliary Panel.



Individual intermittent well flowing or "stop-cocking" (Automatic interval flowing) installation in North Texas Field.

Ask The Men Who USE Them!

STANDARD FOR *Performance*

ARMY E NAVY

HANLON-WATERS, INC. H-W

HANLON-WATERS, Inc.
TULSA, OKLAHOMA

NEW YORK • CHICAGO • PITTSBURGH • PHILADELPHIA • BOSTON • CINCINNATI • ST. LOUIS • KANSAS CITY • DENVER
LOS ANGELES • MOBILE • SHREVEPORT, LA. • FORT WORTH • HOUSTON • CORPUS CHRISTI • AMARILLO and ODESSA, TEXAS

Natural Gas

Buddrus Heads Organization Of Natural Gas Companies

E. Buddrus, president of Panhandle Eastern Pipe Line Co., Chicago, was elected president of the recently organized Independent Natural Gas Association of America at a meeting of the directors held in Tulsa February 18. Paul Kayser, president El Paso (Tex.) Natural Gas Co., was chosen first vice president; J. H. Dunn, vice president Shamrock Oil & Gas Co., Amarillo, Tex., second vice president; F. W. Peters, secretary and treasurer Oklahoma Natural Gas Co., Tulsa, treasurer. Selection of an executive secretary was deferred.

The directors named the following executive committee: W. H. Wildes, president Republic Natural Gas Co., Dallas, Tex.; Joseph Bowes, president Oklahoma Natural Gas Co., Tulsa; D. D. Harrington, of Hagy-Harrington & Marsh, Amarillo; Paul Kayser; E. Buddrus.

The association, Buddrus said, plans to be particularly active in handling the problems of natural-gas producers and royalty owners in all parts of the country. It is expected to have the association represent the natural-gas industry before legislative and administrative bodies. Membership in the association is open to all producers of natural gas, pipe-line companies, and owners of royalty interests in connection with the production of natural gas.

All Turner Valley Gas Wells to Share in Market

CALGARY, Alta. — J. H. McLeod, production manager of Imperial Oil, Ltd., and president of the Royalite Oil Co., announced last week that under legislation to come before the Alberta Legislature at its current session, all natural gas producers in Turner Valley will share in the available market for natural gas. A new company, Madison Natural Gas Co. will gather the gas from Turner Valley wells at the field, put it through the scrubbing plant and deliver to the Canadian Western Natural Gas Co. which supplies Calgary and other southern Alberta communities.

The Madison company will concern itself exclusively with the gathering, transportation and purifying of gas in the field, handling those functions formerly carried on by the Royalite Oil Co. and delivering the gas to the Canadian Western transmission system. It will be a Royalite subsidiary, and its Turner Valley pipe line will be a common carrier.

Surplus gas after the market requirements are satisfied will be stored either in the Bow Island field, for which facilities now exist, or in the Turner Valley formations.

Heretofore, Royalite Oil Co. has been under contracts giving it a preferential position in supplying gas to the Canadian Western system, though it has purchased some gas from independent companies for resale.

Directors of the recently organized Independent Natural Gas Association of America elected these men officers February 18: Paul Kayser, president El Paso Natural Gas Co., first vice president; E. Buddrus, president Panhandle Eastern Pipe Line Co., president; J. H. Dunn, vice president Shamrock Oil & Gas Corp., second vice president. F. W. Peters, secretary-treasurer Oklahoma Natural Gas Co., who does not appear in the picture, was chosen treasurer

War Gas Conference to Be Held in Rochester, N. Y.

The 1944 American Gas Association War Conference on Industrial and Commercial Gas will be held at Hotel Seneca, Rochester, N. Y., March 30 and 31. The conference comes at a time when factories, mills and shops are using more industrial gas than in any previous period; when the greatest number of factory and mill workers are handling industrial-gas equipment and are producing more and more output with industrial gas. These and other conditions have created the greatest impact of the war on the gas load. These will be explored.

The all-important reconversion period will receive attention, as will postwar competitive and technical subjects in the formal program.

FPC Suspends Proposed Increase in Gas Rates

WASHINGTON, D. C. — Federal Power Commission will hold a hearing here March 7 concerning the lawfulness of proposed increased rates for natural gas sold by Godfrey L. Cabot, Inc., to its subsidiary, Cabot Gas Corp., and in turn resold to Pavilion Natural Gas Co. Stating that the proposed increase "may place an undue burden upon ultimate consumers of natural gas," the commission's order provides that "the burden of proof to show that the proposed increased rates are just and reasonable shall be upon Godfrey L. Cabot, Inc., and Cabot Gas Corp."

Defending the proposed rate changes, which would increase the price of the gas sold to Cabot Gas Corp. from 7 cents per 1,000 cu. ft. to 25 cents, or 257 per cent, Godfrey L. Cabot, Inc., says the existing rate "was fixed in 1937, when the quantity delivered to Cabot Gas Corp. was more than 12 times the present quantity available for delivery, based upon very large production of gas in the field in which the company operates. Increased costs of all items, depletion of wells causing great scarcity of gas and a complete failure of return based on the present price require the increase."

Exploration and Drilling

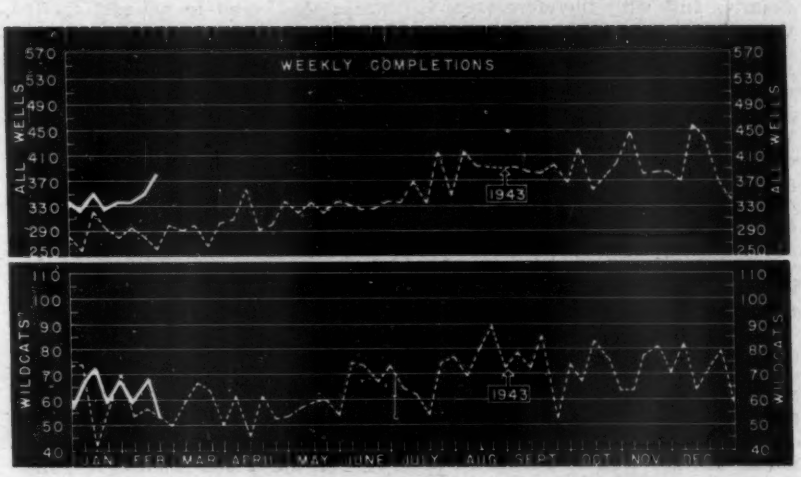
Week's Highlights

ANOTHER potential pool discovery in the southeastern states, possibly the first commercial producer ever drilled in Alabama, this week stimulated interest of operators in that section of the country which is the newest of the potential oil provinces and one in which exploratory activity will be intensified by each discovery and substantial showing.

The prospective Alabama discovery, credited in preliminary reports with indicating production of 75 to 90 bbl. daily, is in Choctaw County, bordering Mississippi. Significance of the Alabama potential pool opener is increased by last week's formal completion of a wildcat discovery at Heidelberg in Jasper County, Mississippi, although the two wells are apparently unrelated from the standpoint of pay section. The Alabama wildcat is showing 17-gravity oil which virtually filled the hole. It is originating in the Selma chalk zone, Middle Cretaceous. Before plugging back to test Selma showings, the Alabama well had been drilled to 5,380 ft., which is 2,820 ft. below top of the chalk section.

Geological information on the Alabama well is not complete but the interval between 2,560 and 5,380 ft., was sufficient to carry through the Cretaceous and probably well into the Mississippian. Selma chalk does not have a particularly impressive producing record but has been proven to contain oil and gas in practically all fields in Mississippi, indicating its competence as a reservoir for hydrocarbon accumulations. The normal section of Selma, a massive and weakly bedded chalk, ranges from 250 to 900 ft. in the southern part of Mississippi.

About 40 miles west of the Alabama wildcat, Gulf Refining Co. officially completely its Heidelberg pool discovery, flowing 492 bbl. daily from the Eutaw sand in the Cretaceous. There was an interval of 1,050 ft. in the Gulf discovery between top of chalk and top of the Eutaw, indicating that the Alabama wildcat tested to a much deeper stratigraphic level without finding the lower members productive. This condition, however, detracts only partially from the primary fact that sedimentary beds and structural conditions in Alabama contain petroleum in commercial quantities.



Solid line charts current weekly completions

COMPLETIONS IN ALL FIELDS . . .

(Week ended February 19, 1944)

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1944	1943
N. Y., Penna., W. Va.	48	13	4	65	128,034	414	388
Ohio	4	10	9	23	46,301	120	94
Indiana	2	0	1	3	5,626	40	34
Kentucky	9	2	1	12	27,871	78	32
Illinois	26	0	11	37	98,807	219	240
Michigan	5	1	10	16	29,950	73	53
Kansas	9	0	12	21	63,739	220	176
Nebraska	2	0	0	2	4,547	8	3
Missouri-Iowa	0	0	0	0	0	3	2
Oklahoma	15	7	13	35	114,877	194	150
Texas:							
North Central Texas	8	0	12	20	57,020	152	153
West Texas	28	0	4	32	140,097	187	112
Texas Panhandle	2	0	1	3	12,221	18	28
Eastern Texas	0	0	3	3	14,743	39	34
Texas Gulf Coast	10	0	9	19	130,642	88	51
Southwest Texas	14	1	4	19	109,720	127	113
Total Texas	62	1	33	96	464,443	591	491
North Louisiana	1	0	3	4	16,234	32	40
Louisiana Gulf Coast	9	0	2	11	104,264	48	49
Total Louisiana	10	0	5	15	120,498	80	89
Arkansas	5	0	2	7	38,611	26	24
Mississippi and Southwest	1	0	1	2	11,479	23	4
Montana	3	0	0	3	10,821	30	20
Wyoming	0	0	0	0	0	14	19
Colorado, Utah	0	0	1	1	5,708	4	1
New Mexico	0	0	1	1	4,460	47	27
California	39	1	3	43	165,517	234	128
Total United States	240	35	107	382	1,342,389	2,419	1,985
Total previous week	196	41	115	352			
Week ending Feb. 20, 1943	152	21	87	260			

CALIFORNIA

Second Well Produces Oil at West Mount Poso

LOS ANGELES, Calif. — Dwight Vedder has proven production in the West Mount Poso field, Kern County, and will, therefore, receive the special allotment accruing to the discovery well in a new field. Vedder's first test at West Mount Poso was a gas well which failed to produce oil despite its completion in the Vedder zone of Miocene. Vedder's discovery at West Mount Poso was a normal completion for the Vedder zone in the east side fields, pumping 125 bbl. daily of 16.3-gravity oil.

Seaboard Oil Co. has started work on its wildcat which will be drilled to test Elysian Park within metropolitan Los Angeles

Hogan Petroleum Co. has made location for a test on the northwest end of the Inglewood field on the Machado property, inside the Culver City limits. Federal Oil Co. has started derrick construction for 5 Smith, another well to be drilled in the northwest end of the Inglewood field. The northwest limits of production are still undetermined.

Standard Oil Co. of California has apparently found a new accumulation of heavy oil in the Kern Bluff section southeast of the old Kern River field. The discovery well was started as one of a series of core holes but ran into oil sand at 970 ft. and this continued to 1,015 ft. The well is Standard 2-10-21, in Section 21-29s-29e, and it was brought in pumping 11 bbl. of 13.6-gravity oil and 1 bbl. of water daily from 990-1,014 ft.

West of Aliso Canyon, the joint wildcat of Barnsdall Oil Co. and Bandini Petroleum Co. on the Roosa lease in 29-3n-16w, resumed drilling after a formation test at 5,740 to 5,842 ft. Objective is the series of Modelo sands in the Miocene which have been found productive by Tide Water Associated Oil Co. The oil sand in 1 Roosa was cored in a badly faulted interval and for this reason some question has existed as to wether the sand was comparable with the upper Modelo or was in the Pliocene. The wildcat may be carried to the Sesnon which is productive in the extreme west and of the Aliso Canyon field. Extension of Sesnon production to include the Roosa property and Standard of California's Frew property to the south would probably double future production of this field as these wells are about 3,000 ft. west of currently proven limits.

Proposals to start wildcat exploration in the Seal Beach area were a step nearer adoption this week. Los Angeles County supervisors voted to grant a lease to Gilco Co. providing the company whipstocked its wells beneath the Flood Control channel and paid the county 7 per cent royalty. The next move will be to ask the city of Seal Beach to permit drilling operations within its corporate limits. Interest in this district is attributed to the possibility there may be another tideland accumulation offshore at Seal Beach.

CALIFORNIA WILDCAT COMPLETIONS

West Mount Poso, Kern County: D. G. Vedder 3-18 Poso, 18-27e-28e, pumped 125 bbl. of 16.1-gravity, 4 per cent cut, TD 2,462 ft., perf. 2,402-62 ft., completed Vedder zone Miocene age; discovery oil well.

Raisin City district, Fresno County: E. W. & H. R. Pauley 31-29 Raisin City, 29-15s-18e, TD 5,696 ft., dry.

DAILY AVERAGE PRODUCTION FOR WEEK

	Feb. 19 crude oil	Distillate, allied products	Feb. PAW quota all oils	Feb. 12 crude oil
Arkansas	78,710	5,100	81,780	78,880
California	796,500	46,700	883,200	791,500
Colorado	8,390	.....	7,000	6,390
Eastern fields	69,450	10,000	82,200	71,575
Illinois	203,825	12,600	227,600	218,450
Indiana	14,320	.....	14,000	13,320
Kansas	268,050	6,100	291,100	281,750
Kentucky	22,920	2,900	28,100	21,750
Louisiana	360,620	27,000	375,700	360,300
North Louisiana	77,420	.....	.....	77,200
Louisiana Gulf	283,200	.....	.....	283,100
Michigan	53,500	200	50,200	53,400
Mississippi	42,600	.....	46,000	43,950
Montana	22,500	300	24,000	23,430
Nebraska	1,150	.....	1,200	1,100
New Mexico	113,100	5,900	116,600	113,050
Oklahoma	345,400	28,000	356,000	327,200
Texas	1,909,250	132,000	2,018,000	1,908,325
East Texas	390,600	.....	.....	390,625
West Texas	362,000	.....	.....	362,100
North Central Texas	139,900	.....	.....	139,950
East Central Texas	110,250	.....	.....	110,250
Texas Panhandle	102,150	.....	.....	102,000
Texas Gulf Coast	705,500	.....	.....	704,600
Southwest Texas	98,850	.....	.....	98,800
Wyoming	97,150	5,800	98,800	98,590
Total United States	4,387,435	282,600	4,701,480	4,412,960

Total production, January 1-February 19, 1944 ..... 219,418,720 bbl.
Same period last year ..... 192,918,315 bbl.

SOUTHWEST TEXAS

Shiner Ranch Wildcat Showing Condensate, Gas

CORPUS CHRISTI, Tex. — Gulf Oil Corp. is testing the 1 Shiner, SW NE Section 55, Shumway subdivision of Shiner ranch, Sidney Sherman Survey, 14 miles south of Tilden in McMullen County. First perforations were reported made at 8,000-06 ft. and recovery was a little gas and condensate on drill-stem test, no gage given. The hole was plugged back and test is now being made higher. Total depth is 8,113 ft. It is credited with sand at 5,480-90 ft., 5,490 to 5,575 ft., 6,642-60 ft., 6,872-81 ft. and some below.

A new sand was opened at East White Point in San Patricio County, when W. R. R. Oil Co. worked over 5 (973) State-Nueces Bay for a dual completion. The new sand, called "Myers" was topped at 5,650 ft. and perforated 5,650-60 ft. Potential was 78.24 bbl. a day on 9/64-in. choke.

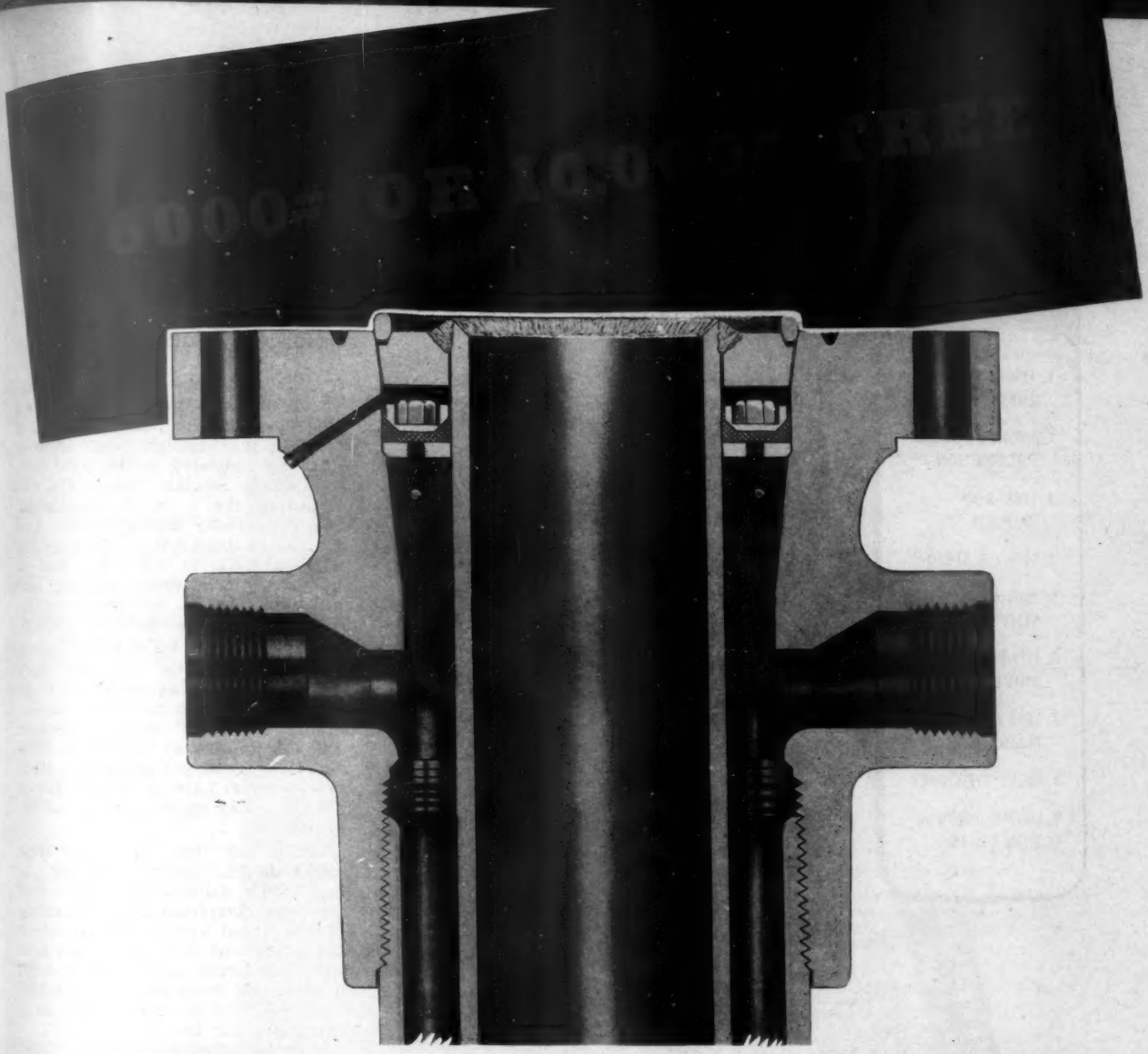
Humble Oil & Refining Co. had set casing in the 1 Pruitt et al, a wildcat in Atascosa County, 2½ miles southwest of Charlotte and near the Frio County line, and operators are preparing to test. Sand was indicated on electrical log and side-wall samples at 4,955-70 ft. carrying oil shows. Total depth is 7,069 ft. and had been scheduled for abandonment before the sand mentioned above was indicated on the log.

Magnolia Petroleum Co. 1 Ingram, 2 miles southwest of Burnell-Wilcox discovery in Bee County, was completed for 51,000,000 cu. ft. of gas per day from the Slick sand of the Carrizo-Wilcox horizon, in perforations at 6,660-70 ft. Total depth is 7,021 ft. and 5½-in. casing is set at 6,885 ft.

Northern Ordnance Co. 1 Heath, discovery a mile north of Mission Valley in northwest edge of Victoria County, was testing through tubing for condensate completion after making additional perforations at 9,850-80 ft. Drill-stem test in perforations at 9,870-80 ft., open 1¾ hours, recovered the 5,000-ft. water cushion and 1,900 ft. of condensate-cut mud. Total depth is 10,814 ft. and 5½-in. casing is set at 9,950 ft. The well also had gas show in sand 8,404-30 ft., show oil and gas 8,430-35 ft. with salt-water sand 8,435-60 ft. Wilcox was topped around 8,000 ft.

LOWER GULF COAST WILDCAT COMPLETIONS

Jim Wells County: Humble O. & R. Co. 1 E. M. Brownlee, in J. Wright Sur. 19, 1½ mi. SW of Alfred, Brownlee field discovery, TD 3,373 ft., 5½-in. set 4,985



THIS CASING HEAD TAKES EITHER ONE . . . WITH NO EXTRA ACCESSORIES!

The RHX RECTORHEAD gives well owners the most valuable single improvement in casing head construction in years. With it you drill to the point of completing your well in high pressure territory, using a 6,000-pound test head as safe, dependable casing suspension. You don't know, until production is reached, whether a 6,000- or a 10,000-pound test Christmas-tree is necessary. With the RHX head, that decision can be made after surface control equipment pressure requirements are determined, because . . by the simple machining of a restricted ring groove in the bottom flange of your tubing head at a small cost . . . you flange a 10,000-pound test tubing head directly onto your RHX casing head with the same safety as you would install a 6,000-pound 'tree. And, you do this without the addition of any extra accessories. An intermediate flange is eliminated. The hook-up is simplified, and less space is required.

Hundreds of these time-, trouble- and money-saving RECTORHEADS are now in satisfactory service. You will profit by getting one on your next well.

RECTOR WELL EQUIPMENT CO., INC.

FT. WORTH, TEXAS

Export LUCEY EXPORT CORP, Woolworth Bldg., N. Y C

Representatives in Active Fields

RECTOR WELL EQUIPMENT CO. INC. "MAKING THE OIL INDUSTRY SAFER"

RECTORHEAD

SUCCESSOR TO THE BRADENHEAD

1. FEWER PULLING JOBS
2. HIGHER VOLUME PRODUCTION
3. LESS ROD TROUBLE
4. SLOWER SPEED
5. MINIMUM FLUID SLIPPAGE
6. LOWER PRIME MOVER COST
7. LESS EQUIPMENT MAINTENANCE
8. MORE EFFICIENCY
9. LOWER PRODUCTION COSTS
You, too, can cut high lifting costs by using the DARLING Multi-Cup Traveling Valve. With this type of lifting the cups expand under the load and press tight against the walls of the barrel to prevent fluid slippage.
After weeks, even months of service the cups still give tight seal against the barrel wall. Volumetric efficiency stays almost constant over periods of months. At greater depths—with abrasive sands—or higher temperatures, the "Multiplicity" of valve cups assures the maximum efficiency of the cup principle and supports the greater loads for a longer time.
If you are still using older types of traveling valves, convert to DARLING. For full information, call on the Darcova engineer right in your locality. Or write, wire or phone the factory for the free Darling Multi-Cup Traveling Valve Bulletin. We're always at your service.
DARCOVA
DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.

ft., perf. 24 shots at 4,948-50 ft., 2-in. set 4,906 ft., comp. for 32 bbl. daily on ½-in. choke.

Nueces County: W. R. R. Oil Co. 5 (973) State-Nueces Bay, new pay discovery at East White Point field, State Tract 973, Nueces Bay, reworked and dual completed, TD after plugging back 5,660 ft., old TD 5,863 ft., new pay topped 5,650 ft., perf. 5,650-60 ft., PT 78.24 bbl. a day 9/64-in. choke, TP 395 lb., gas-oil ratio 420:1, gravity 40.3, no water.

SOUTH TEXAS WILDCAT COMPLETIONS

Duval County: Atlantic Refining Co. 2-A Martex-Welder, wildcat Martex area, M. G. Nunez Sur. 4, A-367, 13 mi. NW of San Diego, dry at 4,007 ft.

SOUTH CENTRAL TEXAS WILDCAT COMPLETIONS

Caldwell County: A. E. Morgan 2 Aileen Taft, in Jonathan Burleson Sur., 3½ mi. W of Lytton Springs, dry at 1,906 ft.

Wilson County: W. B. Phipps 1 R. J. Huebinger, wildcat discovery in Felipe Flau Sur. 9, 3 mi. ESE of Lavernia, TD 1,717 ft., top sand 1,709 ft., no perforations, 6-in. set at 1,707 ft., est. 12 bbl. day pumping, no gas, trace water.

MICHIGAN

Six Failures Dampen Michigan Exploration

SAGINAW, Mich.—Five of the week's 16 oil-test completions in Michigan last week report production. Six of the 11 dry holes were wildcats. One producer, the Ervin Major 3 Bryan in Adams Township, Arenac County, flowed 650 bbl. with some salt water the first 10 hours. Two small producers were developed in Bay County. Other wells in the Goodwell pool, Newyago County, and the Fork field, Mecosta County, produced 31 and 157 bbl., pinched, respectively. In addition Ohio Oil Co. reported a 21,000,000 cu. ft. gasser at Norwich, Newaygo County.

Michigan production continues to decline. Michigan Oil & Gas Association figures estimated the January daily average at 49,912 bbl., a drop of 914 bbl. from December. Reed City continued its sharp drop, down 1,370 bbl. a day to 15,361, compared with December.

The conservation department will hear the industry's first appeal from a decision of the state supervisor of wells on March 13. Thirteen operators have appealed for relief from the order of P. J. Hoffmaster, which reduced the Reed City field allowable.

MICHIGAN WILDCAT COMPLETIONS

Clinton County, Olive Township: E. L. Bennington and C. S. McCutcheon 1 Culp, SW SW SW 17 6n-2w, dry in Dundee, TD 2,880 ft.

Gratiot County, Arcada Township: Arenac Oil & Gas Co. 1 Sherman, C SW 27-11n-13w, dry, TD 970 ft.

Iosco County, Sherman Township: Stork Oil Co. 1 National Gypsum Co., C N½ NE NW 16-21n-6e, dry in Dundee, TD 3,306 ft.

Newaygo County, Big Prairie Township: A. Firth 1 John F. Miller, SW SE SW 9-13n-11w, dry in Munroe, TD 3,380 ft.

Osceola County, Evart Township: Sun Oil Co. D-1 Davy, C S½ SW SE 36-17n-8w, dry, TD 4,093 ft., PB to 3,360 ft.

LeRoy Township: Gordon Oil Co. 1 F. P. Strong, C S½ SW SW 30-19n-10w, dry in Dundee, TD 3,715 ft.

TEXAS GULF COAST

Another Discovery Well in Colorado County Indicated

HOUSTON, Tex.—Colorado County, which has contributed a couple of new fields in the past 3 weeks, is again in the limelight with another discovery indicated in the New Ulm area where Sinclair Prairie Oil Co. is testing the 1 A. J. Thompson, Charles Fridshe Survey. First test was run in about 8 ft. of sand section between 8,172 to 8,201 ft., and it showed gas condensate cleaning into pits, with 2,400 lb. working pressure. Total depth of the hole is 8,735 ft. and 7-in. casing is set at 8,728 ft.

Cities Service Oil Co. and Jack Frazier are preparing to test the C. K. Gay et al, 3 miles northwest of Columbus, James Tumlinson League, Colorado County, at 7,320-24 ft. This wildcat showed gas condensate with some water at 7,810-12 ft., and flowed 97.4 bbl. a day on ¼-in. choke of 44-gravity oil.

A new pay was opened at West Ganado field, Jackson County, in Pure Oil Co. 1 Della Wiese. The well had been completed in perforations 6,000-08 ft. but went to water, so hole was drilled out to 6,190 ft. and new perforations made at 6,174-88 ft. with 66 shots and completed for 194 bbl. a day on 7/64-in. choke. This is a deeper pay for the field.

American Republics Corp. and Houston Oil Co. of Texas have completed the 3-R Cushing-fee, outpost at Ramer Island in Tyler County. Completion was made in open hole below 5½-in. set at 5,395 ft. and potential was 505 bbl. a day through ¼-in. choke. Pay was topped at 5,392 and the hole is bottomed at 5,399 ft.

Humble Oil & Refining Co.'s second test in the new field 1 mile northeast of Rockland, Tyler County, failed to find commercial production in the 3,400-ft. discovery sand, and was dry at 3,575 ft. in sandy shale. This test was about ¾ mile southeast of the discovery pumper.

TEXAS UPPER GULF COAST WILDCAT COMPLETIONS

Fort Bend County: Superior Oil Co. of California 1 Mary V. Lockwood et al, in William McMahon Sur., 5½ mi. SW of Thompson townsite, dry at 8,293 ft.

Jefferson County: Glen H. McCarty 1 Henry Matheis, Lot 30, F. Valmore Sur., 2.7 mi. NW of Hamshire, dry at 10,200 ft.

Matagorda County: Atlantic Refg. Co. 1-B Denman Kuntze, in W. H. Gainer Sur. 550, Tract 9, 9 mi. W of Markham, 1,400 ft. east of 1-A Kountze, dry hole, dry at 7,366 ft.

Polk County: Humble O. & R. Co. 1-C W. T. Carter & Bro., in Jas. H. Finley Sur.

A-249, 3 mi. W NW of Segno field, dry at 8,897 ft.

Trinity County: American Liberty Oil Co. 1 E. M. Due, in S. E. Buffington Sur. A-731, 7 mi. NE of Apple Springs, dry at 5,520 ft.

Tyler County: Humble 2 Denman Kountze et al, Lot 11, Emily Smyth Sur. A-792, Rockland area, dry at 3,575 ft.

Wharton County: Pan American Prodn. Co. 2 J. Brooks Gary, S. F. Austin Lge., wildcat Boling dome flank, dry at 7,898 ft.

Jackson County: Pure Oil Co. 1 Della Weise, new pay discovery at West Ganado, TD 6,360 ft., 5½-in. 6,235 ft., PBTD 6,190 ft., perforated 6,174-88 ft. Comp. 2-8-44; 104 bbl./ day, 7/64-in choke, gravity 33.6, TP 710 lb., GOR 770-1.

LOUISIANA GULF

New Operations Gain in Widely Scattered Areas

NEW ORLEANS, La. — A general gain in new work featured development in the Louisiana Gulf Coast district last week. More than 20 new tests were announced in almost as many parishes.

Tide Water Associated Oil Co. is completing the 26 Buras Levee Board at Venice, 34-21s-30e, Plaquemines Parish, in perforations 10,024-40 ft. The well flowed 11 bbl. an hour on ⅛-in. choke on preliminary test.

North of the Reddell field in Evangeline Parish, Continental Oil Co. and Humble Oil & Refining Co. 4 Pardee Lumber Co., 18-4s-1w, is fishing for stuck drill stem at 12,082 ft. Gulf 2 Schlicher-Thomas, east flank Wilcox test at Pine Prairie, drilling below 11,000 ft. in shale, and the company's 1-B Schlicher-Thomas, Wilcox test on the west flank of the same field, is drilling below 10,520 ft., sandy shale.

Humble has drilled plug in the 1 Federal, wildcat on Laurel Ridge Prospect, 1-11s-13e, and is testing. No details are available. Total depth is 11,650 ft.

Union Sulphur Co. is still cutting and pulling drill pipe at the 1 Edward E. Daigle, a blowout well southwest of Church Point, in 49-7s-2e, Acadia Parish. The well kicked off from a sand topped at 9,815 ft. when it had penetrated the sand only 2 ft. to total depth of 9,817 ft. The hole bridged but drill pipe stuck.

Humble 1 Jos Rathborne Land Co., 25-7s-7e, a wildcat in the Ponchatoula area, fishing at 9,314 ft in shale.

LOUISIANA GULF COAST WILDCAT COMPLETIONS

Evangeline Parish: Danciger O. & R. Co. 1 Bowman-Hicks Lbr. Co., wildcat Beaver prospect, 4-3s-2w, 7 mi. NW of Pine Prairie field, dry at 9,764 ft. in Wilcox topped at 9,290 ft.

St. Landry Parish: Humble 1 Virginia Prince et al, second well at Krotz Springs, 25-6s-6e, ½ mi. SW of Gulf's discovery well, TD 10,210 ft., 7-in. 10,205 ft., perf. 163/10,128-44 ft.; flow 20 bbl. an hour, ¼-in. choke, gravity 50.5, 279,000 cu. ft. gas hour, TP flowing 5,300

Tough As They Come and Plenty Fast

"CLEVELANDS"

NEVER LET YOU DOWN

Literally thousands of miles of completed ditch dug thru soft, sticky, treacherous and stony ground, over the roughest and most difficult terrain prove that "CLEVELAND DITCHERS" have the "guts" to stand up and take it and deliver no matter what the going.

This extreme toughness and stamina in "CLEVELANDS" is due to their correct design and superior quality construction from tougher, harder materials.

A multiplicity of digging and traction speeds instantly available to the operator of a "CLEVELAND" always enables him to cut at maximum speed for the work at hand.

It is this toughness and speed, built into every machine that has given owners the confidence that their "CLEVELANDS" will not "let them down." And this is why today "CLEVELANDS" are delivering maximum performance on a multitude of civilian and government projects at home and in the war theaters.

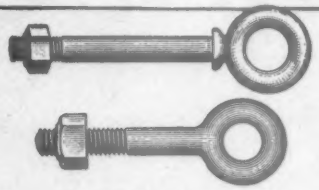
THE CLEVELAND TRENCHER COMPANY

20100 ST. CLAIR AVE. Pioneer of the Small Trencher CLEVELAND, OHIO

"CLEVELANDS" Save More . . . Because they Do More

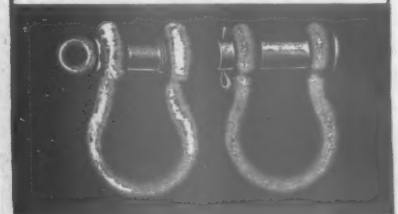
HERE'S A LINK
FREE FROM PLAY
OR
SHEARING ACTION
ON THE RIVET

Laughlin's drop-forged, heat-treated "Missing Link" is matched under pressure . . . so there is no play between the halves, no shearing action on the rivet. Under stress, the rivet merely holds the missing link together. The interlocking lugs take the load.



WIDE RANGE OF EYE BOLTS

Laughlin's drop-forged, weldless eye bolts are available in any length or diameter, with or without thread or shoulder. Galvanized or Plain. Stock sizes: ¼" x 2" to 1¼" x 20".



SHACKLES MADE TO
U. S. GOVERNMENT TOLERANCES

Drop-forged steel, weldless anchor shackles, made in all sizes from 3/16" to 2½". Can be furnished with either screw pin, round pin or bolt and nut. Galvanized or Plain-finish.

Write for latest Catalog on Laughlin Industrial Hardware

Distributed through
Mill, Mine, and Oil Field Supply Houses

FORGING A SHARE IN VICTORY

THE THOMAS LAUGHLIN Company
PORTLAND 6, MAINE

lb., shutin TP 5,725 lb., GOR 13,945-1, trace b.s. and water.

ROCKY MOUNTAIN

Locations Made for Further Tests in New Area

DENVER, Colo. — The two exploratory wells 4 miles apart on the flanks of the Garland dome which have found good oil saturation in the Tensleep sand below the gas cap in that horizon have definitely shown the absence of any native water in the sand and confirm the original estimates of the importance of the discoveries. These are the Ohio Oil Co. 5 Ohio-Kinney-Coastal unit, NW SW SW 13-56n-98w, on the northwest flank in Park County, and General Petroleum Corp. 1 Howell Lot 63, SW SE 53, 56n-97w, on the southern flank. Both companies have made locations for additional tests still lower on structure.

The Ohio well, which is bottomed in sand at 4,485 ft. with the 5½-in. at 4,350 ft., after exhausting the drilling water, swabbed 5 bbl. of pipe-line oil an hour at the beginning of the test. It is expected to improve as the channels are opened up, and J. A. Warren, president of Kinney-Coastal Oil Co., estimates the well, on the basis of the performance of wells on the adjoining Byron dome, will make at least 250 bbl. per day on the pump.

Ohio's new location is in the NW NW SW 13-56-98, approximately 100 ft. lower on structure and ¼ mile north of No. 5. The General Petroleum 1 Howell has not yet been given a pumping test, but swabbed 250 bbl. of clean oil in 24 hours. It was not a continuous test, however, and set up no rate of production. It did not flow and will go on the pump. This company's new location is ½ mile southeast of 1 Howell and approximately 200 ft. lower on structure. It is 990 ft. east of the west line and 330 ft. south of the north line out of the northwest corner of Lot 53-55n-97w. The failure of the wells to flow is credited principally to the lowering of the gas pressure in the sand in 1936 and early 1937 when a gas well blew out and resulted in the loss of approximately 20 billion cubic feet before it was brought under control.

Water in Embar of Little Grass Creek.—Continental Oil Co. 3 Mountain States Power, C SE NE 11-46n-99w, Little Grass Creek, made a drillstem test in the Embar at 5,849-64 ft. and with tester open 15 minutes it showed 1,182 ft. of water and no oil. It is coring ahead for the Tensleep. This is one of the small Big Horn basin structures which showed gas or oil in upper formations but which never had been tested to the Tensleep prior to the discovery of oil in that horizon at Elk Basin. Two old wells on the dome made 30,000,000 and 10,000,000 cu. ft. of gas from the Frontier at the time of completion. It is separated from the Grass Creek field by a narrow syncline.

New location at Gage. — Northern Ordnance, Inc., is moving in rig for its 1-B Morris, C SE NW 14-9n-26e, Gage dome, Musselshell County, Montana; ½ mile west of 1 Darr, recently completed in the Amsden at 6,087-6,125 ft.

Amerada at Clark's Lake.—Amerada Petroleum Corp., joint with Alder Oil Co., is moving rig ¼ mile south of its discovery on Clark's Lake, Larimer County, Colorado, and will drill a second well. The discovery is estimated capable of making 50 bbl. per day on the pump from the Muddy sand at 5,888-5,969 ft., although it has not yet been tested.

COLORADO WILDCAT COMPLETION

South McCallum, Jackson County: Continental Oil Co. 4-A Hove, NE NE SW 27-9n-78w, TD 5,708 ft., 7-in. 5,695 ft., Lakota sand, through 475 perf. at 5,555-5,650 ft., 7,000,000 cu. ft. carbon dioxide gas and 8¾ bbl. of oil in 22 hours; second Dakota, through 125 perf. at 5,520-41 ft., 6,421,000 cu. ft. carbon dioxide gas and 5 bbl. of oil in 19 hours; first Dakota, through 350 holes at 5,420-90 ft., 4,600,000 cu. ft. carbon dioxide gas and 11½ bbl. of oil in 30 hours; second Frontier through 100 holes at 4,390-4,416 ft., no oil or gas; first Frontier, through 475 holes at 4,290-4,375 ft., swabbed dry, showing neither oil or gas, hole filled to the top and shut in.

MONTANA WILDCAT COMPLETION

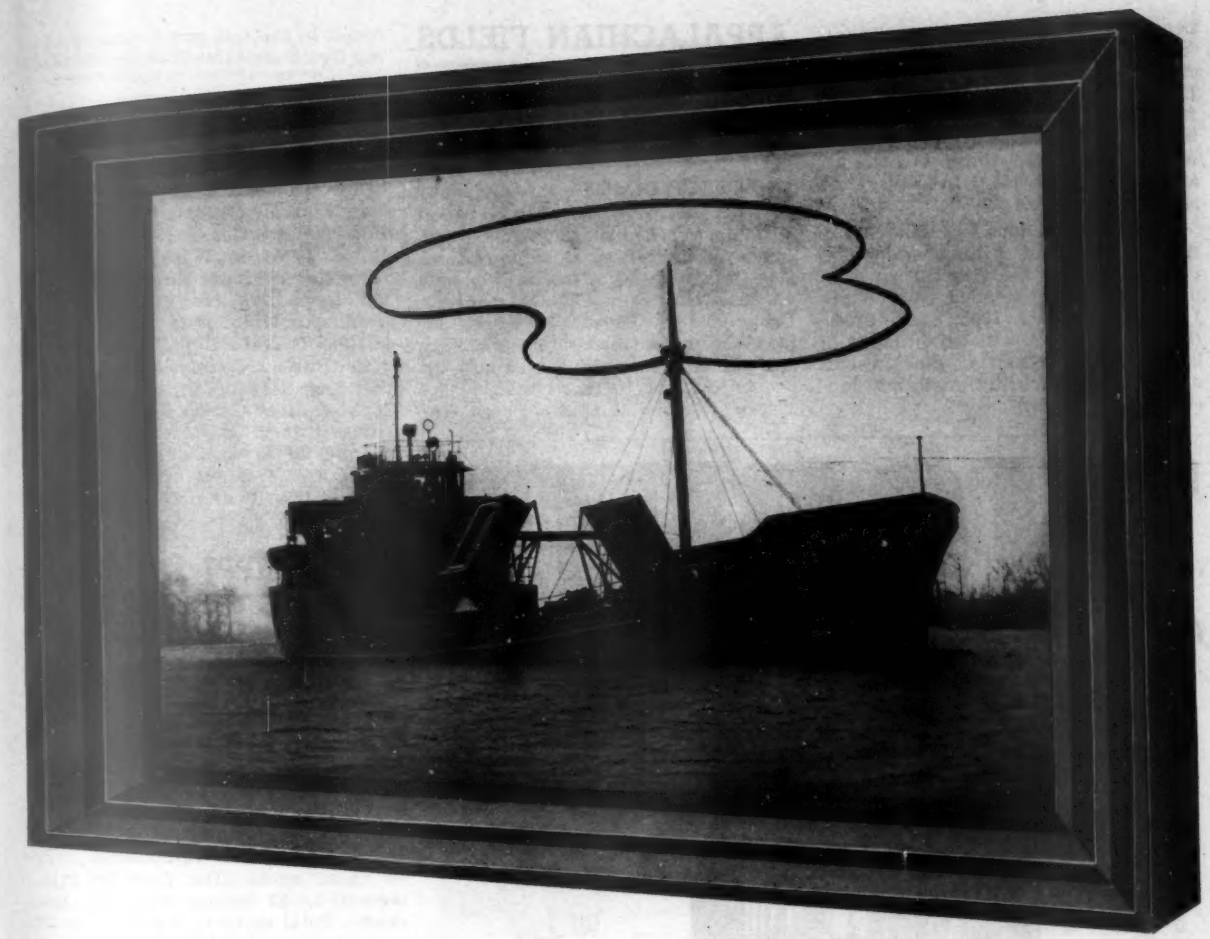
Gage, Musselshell County: Northern Ordnance, Inc. 1 Darr, C SE NE 14-9n-26e, TD 6,125 ft., top of Amsden 6,087 ft., flowed 358 bbl. first 24 hours, will put on pump, tops Eagle 3,080 ft., Colorado 4,460 ft., Kootenai, 5,380 ft., Morrison 5,690 ft.

CANADIAN FIELDS

Southwest Extension to Taber Pumps 200 Bbl.

CHATHAM, Ont. — Possible extension of the Taber field in southern Alberta to the south and west is indicated by Mid-Continent Oil & Gas No. 3, LSD 13, 1-8-17w4. Finished in the Raber sand at 3,235 ft., it plugged off the bottom 8 ft., where water was encountered and obtained water-free crude. The well swabbed around 8 to 10 bbl. an hour, or 200 bbl. daily, production being similar to that encountered in the Dominion wells in the main field approximately 10 miles to the north and east. Swabbing is being continued until the well is cleaned, after which a pump will be installed for a definite production test. Nos. 4 and 5 will be started immediately as offsets to 3.

Skiff. — Border areas east of the Taber field and west of the Skiff field, where a similar production of



PORTRAIT OF A PIPELINE

From East Texas to East Asia

Typical of Levingston's versatile shipbuilding facilities are these comparatively small, shallow draft tankers constructed for the U. S. Army to deliver fighting fuel to amphibious invasion forces. While tanker construction is "out of our line", the job had to be done . . . in a hurry . . . and we did it.

Although ship construction for the armed services . . . rescue vessels for the Navy, tugs for both the Army and the Navy . . . is given priority, Levingston's reputation for fast and dependable ship repairs has been maintained. Tug operators contemplating the purchase of new vessels are invited to investigate Levingston's record for building the finest marine equipment money can buy.

Levingston

SHIPBUILDING COMPANY

ORANGE TEXAS

ARMY-NAVY E

BACK THE ATTACK! ★ Buy More War Bonds!

heavy crude was encountered in 1927, will be tested by Dominion Oils. About 40 miles southeast of Taber, Dominion-Province 1, LSD 1, 14-5-12w4, has been located near Foremost. Dominion-Grassy Lake Province 1, LSD 3, 15-9-13w4, will test an area where Imperial Oil recently finished a dry hole.

Alberta regulations.—The time limit for installation of drilling equipment on leases from the Alberta government has been extended from April 1, 1944, to April 1, 1945; and intimation has been given that the time will be further extended if the present difficulty in securing material and equipment persists.

APPALACHIAN FIELDS

Two Oriskany Tests Log Markers in West Virginia

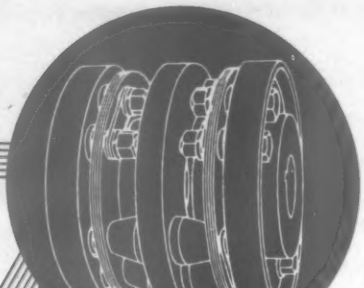
PITTSBURGH, Pa. — Two Oriskany wildcats in Wood County, West Virginia, reached markers this week. In the Williams district, Hope Natural Gas Co. struck a gas pay in the shale at 8840 Big Run Oil Co. (Joanna Drake) which gaged 537,000 cu. ft. from an unidentified sandy and limy shale at 2,682 ft. which increased with deeper drilling to more than 1,000,000 cu. ft. open flow. No Berea was found in the test and the gas producing formation is well below that horizon.

In Union district, Wood County, West Virginia Gas Corp. topped the Corniferous lime at 4,297 ft. in the Peter Seebaugh test, about 3,451 ft. below sea level.

In Jackson County, West Virginia, Hope Natural Gas Co., deepening 8585 B. M. Pfost in Washington district from the Oriskany sand to the Clinton, topped the Newburg horizon in the Lockport dolomite at 6,072 ft. and at 6,089 ft. had a hole full of water.

In Butler County, Pennsylvania, the deep test of the Manufacturers Light & Heat Co. on the J. G. Hockenberry farm in Mercer Township, about 2 miles west of Forestville on Route 8, is now expected to be deepened to the Trenton (Ordovician).

THOMAS
Flexible COUPLINGS



TYPE D8Z
TYPE DSM
TYPE CM
TYPE AM
TYPE-MT
TYPE SS

Eliminate BACKLASH, FRICTION, WEAR AND CROSS-PULL
the four destructive evils of other types and makes of couplings that prevent a permanent care-free installation.

The Thomas All-Metal Coupling has:
No Chains, No Gears, No Rubber.
No Lubrication Required

TYPE D8Z-D

WRITE FOR COMPLETE ENGINEERING CATALOG

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

MISSISSIPPI

Gulf's Discovery Opens Probable Major Fields

JACKSON, Miss.—Gulf Refining Co. completed the 1 Ellen Morrison to open what appears to be another major Mississippi oil field. The discovery well was completed through perforations with 60 shots at 4,958-68 ft., flowing 492 bbl. of pipe-line oil daily on ⅜-in. choke. The flow later increased to 22 bbl. an hour on same choke. Total depth is 6,578 ft. and 7-in. was set at 5,074 ft. Production is from Eutaw sand. This field, named Heidelberg, is in 30-1n-13e, Jasper County.

On the Ruth dome in Lincoln County, The California Co. 1 Board of Supervisors, 16-5n-9e, with total depth of 8,704 ft. and with 7-in. set at 8,704 ft., was shut down for orders after recovering salt water at 8,508-18 ft. and only drilling mud at 8,464-75 ft. on formation tests.

Jasper County: Gulf 1 Ellen Morrison, discovery well in Heidelburg field, 30-1n-13e; formation tops: Wautubee 495 ft., Camerina 525, Wilcox 1,120, Midway 3,160, Chalk 3,690, Eutaw 4,740 ,Marine Tuscaloosa 4,992, Davis zone 6,024; TD 6,578 ft. in red shale, perf. 60 shots at 4,958-68 ft., 2½-in. on packer 4,919, flowed 492 bbl. on ⅜-in. choke, TP 90 lb.

ALABAMA

MONTGOMERY, Ala. — Alabama seems in line for its first commercial oil production as Hunt Oil Co. continues testing 1 A. R. Jackson, a wildcat in 2-10n-1w, Choctaw County. After drilling to 5,380 ft., operator set a mixed string of 5 and 7-in. casing to 2,559 ft. to the top of chalk reported at 2,560 ft. Tubing was run to 2,539 ft. and the well was swabbed and began showing oil. Although no flow had been reported, the hole was practically full of fluid, most of which is 17-gravity oil.

OHIO, KENTUCKY

Preston Oil Co. Extends Clayton Pool Northwest

ZANESVILLE, Ohio.—The Clayton pool was extended a location to the northwest by Preston Oil Co. 4 Loveberry in Section 5, Clayton Township. Forty feet of sand at 3,102-42 ft. was shot and the well produced 115 bbl. the first day. Preston is drilling three wells ½ mile to the south, one of which has been drilled in with 1,800 ft. of oil in the hole.

R. W. Healey et al of Pittsburgh, Pa., have leased a block of acreage in Columbia Township, Meigs County, and will drill a wildcat in Section 16. The Clinton will be found at approximately 3,600 ft.

Two wells will be drilled in Center Township, Monroe County, east and southeast of Woodsfield to test the Third Warren sand found by the South Penn Oil Co. while drilling to the Oriskany west of the town.

OHIO WILDCAT COMPLETION

Muskingum County, Falls Township: Wittmer 1 Alice Marshall, 2nd Qr., Clinton 3,412-3,465 ft., dry, TD 3,514 ft.

WESTERN KENTUCKY

OWENSBORO, Ky.—Carter Oil Co. 1 W. A. Rhodes, in the Hitesville pool in Union County was tested in Levias lime at 2,554-58 ft., after a 3,000-gal. acid treatment and it flowed 614 bbl. of oil through a ¾-in. choke in 10 hours. The well was killed with water until sufficient tankage could be provided, after which the well flowed 1,476 bbl. in 24 hours through ¾-in. choke. It is the largest producer in the pool thus far. It also had oil saturation in McClosky lime at 2,602-06 ft. which was not tested.

Two wildcats were drilling McClosky lime, Sunt Oil Co. 1 Ed Nally in Henderson County and Carter Oil Co. 1 W. N. Vaught, 3 miles northwest of Rochester.

Sinclair Prairie Oil Co. 1 Ashby, near Poole, Webster County, had the earmarks of a successful producer from Tar Springs sand at 1,798-1,808 ft. A 1-hour drill-stem test recovered 500 ft. of oil and 180 ft. of oil-cut mud.

EASTERN KENTUCKY

ASHLAND, Ky.—Two oil wells and two gas wells were reported completed in Eastern Kentucky this week. One of the gas wells was an unusually large producer for the area.

Johnny Bush et al have completed 1 L. & N. Railway, on Torrent Creek, Wolfe County. The well, ½ mile from the Torrent station, is producing 2 bbl. of oil daily.

The Virginian Gasoline & Oil Co. completed well 5 A. L. Moore, on Wolf Creek in Martin County with a daily production of 5 bbl. of oil.

The Kentucky West Virginia company reports the completion of 535 Dan J. Syck, on Raccoon Creek, Pike County, at 3,100 ft. in shale with a daily open flow of 2,373,000 cu. ft. of gas.

ILLINOIS

Completions Average High In Initial Production

CENTRALIA, Ill. — Twenty-six oil wells were completed in Illinois in the past week, with a total initial production of 6,022 bbl., or an average of 231 bbl. per well. The average initial production in 1943 was 123 bbl. per well.

In the north Markham pool Magnolia Petroleum Co. 1 P. A. Lake, SW SW NW 18-2s-5e, pumped 708 bbl. in 24 hours from McClosky lime at 3,028-35 ft., which had been acidized.

In the Mount Erie pool in Wayne County, Pure Oil Co. completed a 678-bbl. well, pumping and flowing, from McClosky lime at 3,091-3,100 ft.

Robinson-Puckett, Inc., found production in a wildcat, 1 Felix, SE NE SE 12-3s-7e, in Big Mound Township, east of the Aden pool, Wayne County. Aux Vases sand was found at 3,240-52 ft., total depth 3,258 ft., and with-

NO SHUTDOWNS
WITH
MURPHY DIESELS

The engines that power your drilling rigs, mud pumps and substations are the prime movers . . . any shut-down of their power means work-stoppage of other equipment . . . non-productive machine-hours and man-hours pile up loss. • *Murphy Diesels* are insurance against power shut-downs. Dependable, economical, trouble-free power is assured by these rugged engines. They are simple, easy to start, and need no specialist to operate or maintain. They are relatively light in weight, compact, readily portable. Low-cost operation . . . less maintenance expense and no unnecessary shut-downs . . . that's why *Murphy Diesels* mean *More Power, More Profit* on oil field operations. Write for bulletin.

MURPHY DIESEL COMPANY
5305 West Burnham Street
Milwaukee 14, Wisconsin

BUY U. S. WAR BONDS

out being shot the well pumped 129 bbl. in 24 hours, about 2 bbl. of water showing with the oil. All other wildcat completions were dry.

Thirty-five new operations were started during the week, of which seven were wildcats.

ILLINOIS WILDCAT COMPLETIONS

Bond County: L. E. Webb et al 1 Mueller, SE NW SE 2-4n-1w, dry at 1,690 ft.

Clark County: L. D. Ring 1 D. L. Downey, NE NE SW 4-9n-13w, dry at 477 ft.

Fayette County: Texas 1 Howard-Whitford, SE SE SW 27-5n-4e, dry at 2,657 ft.

Wayne County: Robinson-Puckett, Inc. 1 Felix, SE NE SE 12-3s-7e, Aux Vases sand 3,240-52 ft., TD 3,258 ft., pumped 129 bbl. of oil, 2 per cent cut; no shot. Pool opener.

Marion County: Texas 1 C. Heistand, SE SE SE 16-3n-3e, dry at 2,590 ft.

Wabash County: George C. Schoonmaker, 1 Cowling, SW SW SE 16-2s-14w, dry at 3,151 ft. Menard 2,210 ft., Cypress 2,701 ft., Benoist 2,805 ft., Aux Vases 2,970 ft., St. Louis 3,147 ft.

White County: Kubat 1 Sturm, C N½ NE NE 14-4s-10e, dry at 3,220 ft.

N. CENTRAL TEXAS

Northeast Archer Wildcat Showing For Discovery

WICHITA FALLS, Tex.—Indications for opening a new field in northeastern Archer County were considered bright this week at Bridwell Oil Co. 1 J. S. Bridwell River ranch, Lot 3, Word and Housel subdivision, 3 miles northeast of Scotland. This wildcat, scheduled to go 6,000 ft. deep, has had several encouraging shows. It logged sand showing oil from 3,838-53 ft., and drill-stem test from 3,837-53 showed 40 ft. of drilling mud cut with oil. More sand was drilled from 4,758-60 ft.; 4,760-74 ft., and drill-stem test at 4,759-74 ft. showed 150 ft. of oil-cut mud, no water. The test is being cored ahead, and may continue to the scheduled depth before attempt is made to complete.

Clay County.—Lacy & Flannery 1 M. M. Lyles, San Augustine University Survey, 1 mile southwest of Burns-Midway Mississippi lime pool, failed to indicate producing possibilities in the Mississippi lime at 6,234 ft., and plugged back and perforated opposite the Bend conglomerate showings from 5,870-80 ft., where it showed both oil and gas in small quantities after treating with 1,500 gal. of acid. On the north edge of the Joy Mississippi pool, Consolidated Oil Co. 5 Viola Myers was drilled deeper to 6,037 ft., and showed good for 300 bbl. per day natural, and probably will be treated with acid.

Young County. — A. G. Bedner 1 Finley, a wildcat in Section 6, J. Poitevent Survey, east of Graham, has been completed for initial potential of 35 bbl. of oil, and 7 bbl. of water. Production is through perforations opposite Caddo lime at 3,915-70 ft. and at 4,040-95 ft. The formation was treated with 2,000 gal. of acid. In the Sewell area, Shell Oil Co., Inc. 1 J. S. Bridwell gaged 5,600,000 cu. ft. of gas from total depth of 4,020 ft.

"Count on us, son...
BOTTOM WATER SEEPAGE WON'T SLOW DOWN OUR PRODUCTION!"
You, too, can be confident bottom water shut-downs won't cause costly delays in your production of the oil our war effort so urgently needs. When you strike bottom water, quickly tamp a cartridge of Eagle Lead Wool into the hole. The fine, flexible strands of this metallic wool effectively pack every crack and corner, become a solid, snug-fitting plug, permanent and non-corrosive. Economical Eagle Lead Wool is rapidly installed in Eagle Wire Containers, sized to fit all casings. Safeguard against bottom water sabotage — order through your jobber today!
EAGLE
1843 EP 1943
PICHER
EAGLE LEAD WOOL
Seals off Bottom Water - Keeps 'em Flowing!
The EAGLE-PICHER LEAD COMPANY · Cincinnati, Ohio

These 3 Eagle Bearing Metals meet most requirements . . .
Eagle Dreadnaught — for extreme speed and pressure conditions
Eagle Outlasta — for medium speed and pressure conditions
Eagle Durable — for low speed and pressure conditions

WEST CENTRAL TEXAS

ABILENE, Tex. — W. E. Ball and Charles R. Franchot 1 H. C. Michie, J. L. Luckenback Survey, 4½ miles west of Burkett, Coleman County, at total depth of 3,319 ft., has been showing oil and gas from the Ranger lime, and will cement casing to test. Elevation of the test is 1,688 ft., and top of Caddo lime was called at 2,754 ft.

Phillips Petroleum Co. 1 J. Ballard, near the center of D. W. Cloud Survey, 4½ miles north of Coleman, was rigging up spudder to drill in and test a showing of oil at 2,400 ft.

In Jones County, Fain & McGaha 1 Rex Smith, 4,000-ft. test in Section 3, Block 17, T&P Survey, was drilling near 2,000 ft., and observers say that a thinning of section seems to be occurring, placing the wildcat in favorable structural position. It is 1 mile north of the Patterson pool, producing from the Tannehill sand at 2,206 ft.

In Stephens County, temporary abandonment was ordered for the north and west offsets to the Corbett Ranch pool discovery. Neither of the tests reacted favorably to acid treat-

ment in the Marble Falls lime pay at about 4,000 ft. Ben F. Read 2 W. A. Corbett, west offset, drilled to total depth 4,175 ft., and 3 Corbett, north offset, was drilled to total depth of 4,143 ft.

EASTERN TEXAS

Navarro County Wildcat To Test Rodessa Zone

DALLAS, Tex.—Favorable indications on Schlumberger log of Brown & Wheeler, Inc., et al 1 Guy Gibson, Navarro County wildcat, 6 miles west of Cayuga field near the Freestone County line, in J. Fontenoy Survey, have caused operators to cement casing at 6,888 ft. and seven zones in the Rodessa formation will be tested by perforating the casing. First perforations will be 90 shots from 6,765-74 ft. The wildcat has been drilled tight and no tops are available, but it is understood that the Schlumberger log was encouraging. The wildcat is on a large block of acreage assembled last summer after it had been worked by seismograph. Several Woodbine dry holes have been drilled in the vicinity, some of which have had shows of oil, but a subsurface map worked on this horizon does not show any substantial relief. Original goal was the Travis Peak or 10,000 ft., but the hole is now bottomed at 7,528 ft.

Smith County.—Arkansas Fuel Oil Co. 1 Priscilla Marsh, T. M. Hawkins Survey, Sand Flat area, promised to be the first completion for the area when it found saturated sand in the Paluxy topped at 7,058 ft., with saturation logged from 7,080 to 7,120 ft. This zone was perforated with 182 shots, and the operators were preparing to swab. Total depth of the well is 7,378 ft., with 5½-in. casing cemented on bottom. The first well indicating production in the area, Skelly Oil Co. 1 Chisum, has been perforating and testing various likely zones for the past several weeks. Tubing collapsed in the hole while treating the zone at 6,960 to 7,274 ft. with acid.

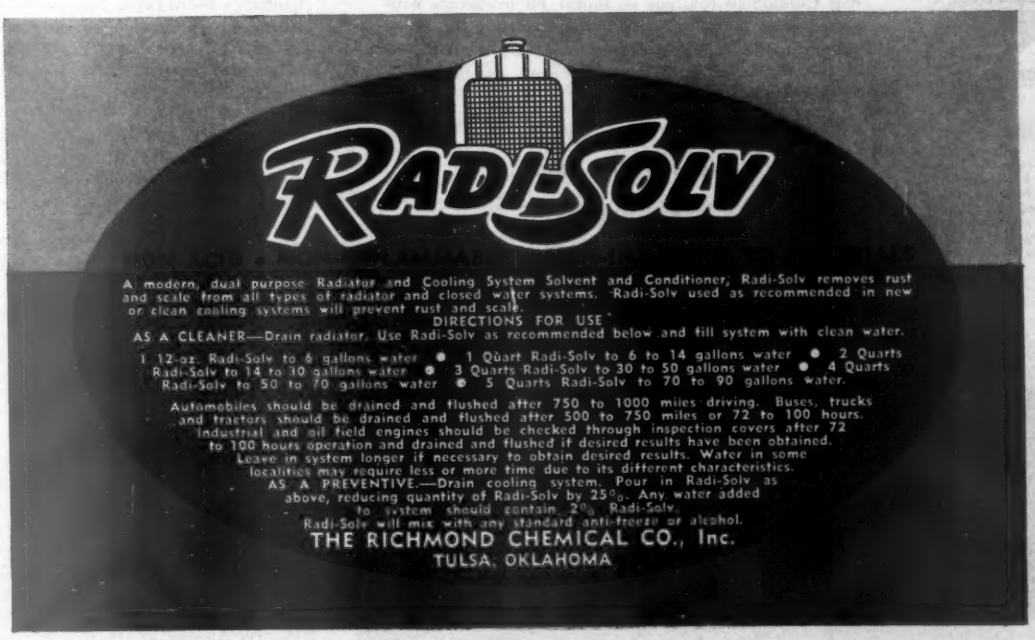
Panola County.—Continental Oil Co. 1 Burnett Bros., Cheairs Survey, Carthage area, perforated casing opposite Hill zone at 4,955-85 ft., treated with 1,500 gal. acid, and the well flowed at a rate of 8,000,000 cu. ft. of gas with 144 bbl. of water-white condensate per day. This flow was killed, and casing from 5,695 to 5,735 ft. was perforated with 120 shots. After being treated with 1,500 gal. acid, the well flowed 7,730,000 cu. ft. of gas with 96 bbl. of distillate per day. Additional tests are being made. Total depth is 9,306 ft.

Wood County.—Hunt Oil Co. 1 Kennedy, southeast of the Quitman pool and 2 miles northwest of Quitman, A. C. Walters Survey, topped Paluxy sand at 6,366 ft. and cored through it with no shows reported. Glen Rose was topped at 6,396 ft.

PERMIAN BASIN

New Clear Fork Pool for Southern Winkler County

MIDLAND, Tex.—A new oil field, producing from the Clear Fork lime, lower Permian, appears to have been discovered in southern Winkler County, 6 miles north and west of the Monahans pool, which produces from Clear Fork and Ellenburger. The new strike is Stanolind Oil & Gas Co. 1 Sealy-Smith Foundation, SW SW Section 50, Block A, G&MMB&A Survey. On a 55-minute drill-stem test from 6,088 to 6,133 ft., with ⅝-in. bottom-hole choke, the well showed gas in 3 minutes. At the end of 30 minutes the well sprayed gas-cut mud and distillate, and at the end of the test it was spraying oil at the estimated rate of 10 bbl. per hour. Gravity was estimated to be 53 degrees. The well was then cored from 6,133-48 ft., recovering honeycomb formation with good oil content. Nearest Clear Fork producer is Shell Oil Co.,


RADI-SOLV
A modern, dual purpose Radiator and Cooling System Solvent and Conditioner, Radi-Solv removes rust and scale from all types of radiator and closed water systems. Radi-Solv used as recommended in new or clean cooling systems will prevent rust and scale.
DIRECTIONS FOR USE
AS A CLEANER—Drain radiator. Use Radi-Solv as recommended below and fill system with clean water.
1 12-oz. Radi-Solv to 6 gallons water • 1 Quart Radi-Solv to 6 to 14 gallons water • 2 Quarts Radi-Solv to 14 to 30 gallons water • 3 Quarts Radi-Solv to 30 to 50 gallons water • 4 Quarts Radi-Solv to 50 to 70 gallons water • 5 Quarts Radi-Solv to 70 to 90 gallons water.
Automobiles should be drained and flushed after 750 to 1000 miles driving. Buses, trucks and tractors should be drained and flushed after 500 to 750 miles or 72 to 100 hours. Industrial and oil field engines should be checked through inspection covers after 72 to 100 hours operation and drained and flushed if desired results have been obtained. Leave in system longer if necessary to obtain desired results. Water in some localities may require less or more time due to its different characteristics.
AS A PREVENTIVE.—Drain cooling system. Pour in Radi-Solv as above, reducing quantity of Radi-Solv by 25%. Any water added to system should contain 2% Radi-Solv.
Radi-Solv will mix with any standard anti-freeze or alcohol.
THE RICHMOND CHEMICAL CO., Inc.
TULSA, OKLAHOMA
FOR SALE BY LEADING OIL WELL SUPPLY COMPANIES
FOR COMPLETE INFORMATION AND PRICES ADDRESS
THE RICHMOND CHEMICAL CO., 306 E. 4th, TULSA 3, OKLAHOMA

Inc., 2 Sealy-Smith Foundation, in the Monahans pool, which is bottomed at 5,741 ft. It would appear that the new discovery is considerably lower on the producing horizon, probably in the Tubb pay, than the Shell producer.

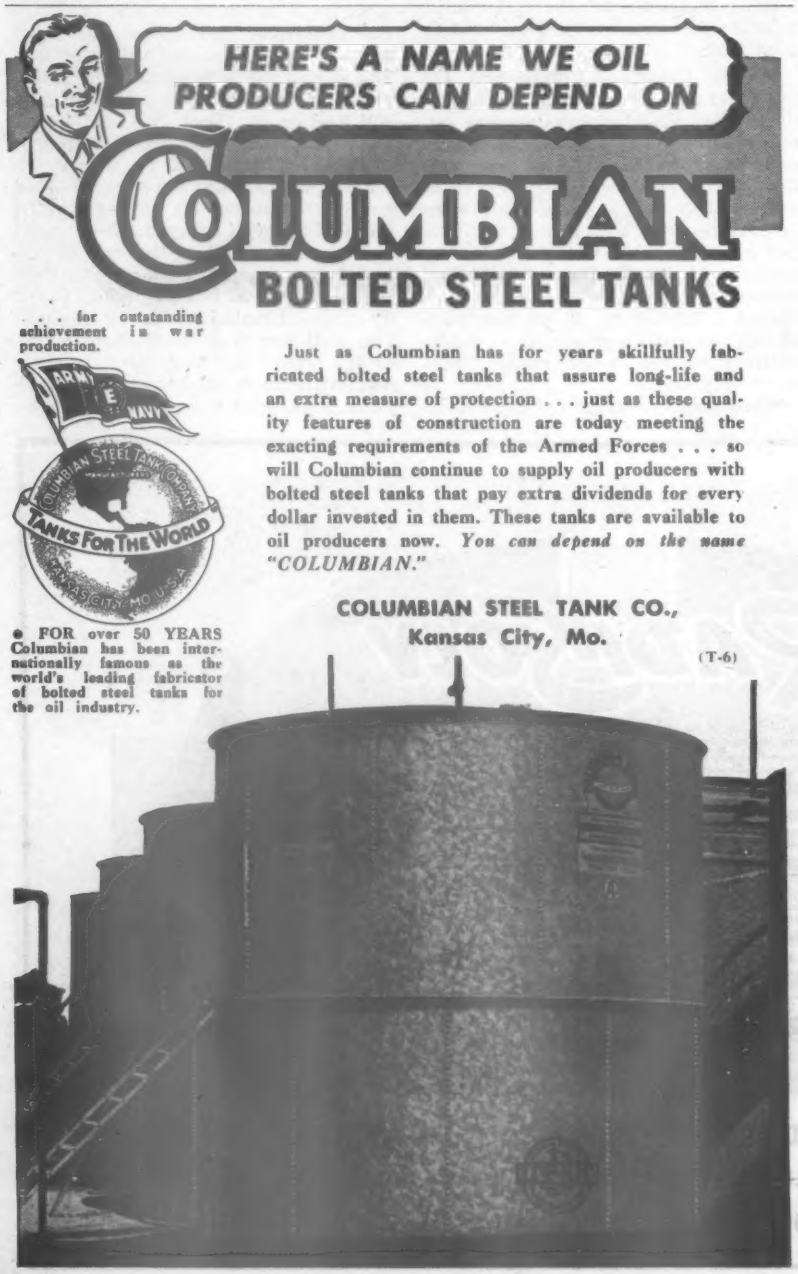
In the Kermit-Ellenburger area. Magnolia Petroleum Co. 234 J. B. Walton, northwest of the discovery, topped Simpson at 9,700 ft., which is 233 ft. lower than the subsea depth at which pay was logged in the discovery. It is drilling below 9,800 ft.

Hockley County.—Stanolind 1 Tom Cobb, Block 103E, League 75, Haskell County School Land, opened a new San Andres lime pool by swabbing 133 bbl. fluid in 18 hours after treating the pay, topped at 4,639 ft., with 2,000 gal. of acid. A later swabbing gage showed 167 bbl. per day, 17 per cent basic sediment and water. Additional tests are being made. Total depth of the new discovery is 4,669 ft. It is 15 miles north of the north edge of the Slaughter pool, and the oil zone is comparable to the second pay at Slaughter.

Ward County.—Second Ellenburger producer for the Monahans pool was assured at Shell 3 Sealy-Smith Foundation, ½ mile west of the discovery, when it began flowing on drill-stem test, after being open 37 minutes, and at the end of 5 hours had flowed 93 bbl. 46-gravity oil. Total depth of the new well is 10,496 ft., plugged back to 10,423 ft., and perforated with 20 shots per foot from 10,410-20 ft.

Gaines County.—Possibility of San Andres lime production in the Russell pool, Clear Fork lime pool in northwest Gaines County, was seen as Shell 1 Jones, NW NW Section 490, Block G, CCSD&RGNG Survey, encountered some stains and saturation at 4,895 ft., and on drill-stem test from 4,850 to 5,000 ft., showed oil and gas-cut drilling mud after 71 minutes.

Yoakum County.—Humble Oil & Refining Co. 1 Fillingim, SE NE Section 6661, Block D, Gibson Survey, 4 miles northwest of the Wasson pool, on 42-minute drill-stem test from 5,246 to 5,315 ft. showed 35 ft. of slightly oil-cut mud, and was drilling ahead.


HERE'S A NAME WE OIL PRODUCERS CAN DEPEND ON
COLUMBIAN
BOLTED STEEL TANKS
. . . for outstanding achievement in war production.
ARMY E NAVY
COLUMBIAN STEEL TANK COMPANY
TANKS FOR THE WORLD
KANSAS CITY, MO. U.S.A.
• FOR over 50 YEARS Columbian has been internationally famous as the world's leading fabricator of bolted steel tanks for the oil industry.
Just as Columbian has for years skillfully fabricated bolted steel tanks that assure long-life and an extra measure of protection . . . just as these quality features of construction are today meeting the exacting requirements of the Armed Forces . . . so will Columbian continue to supply oil producers with bolted steel tanks that pay extra dividends for every dollar invested in them. These tanks are available to oil producers now. You can depend on the name "COLUMBIAN."
COLUMBIAN STEEL TANK CO.,
Kansas City, Mo.
(T-6)

SOUTHEAST NEW MEXICO

HOBBS, N. M.—Skelly Oil Co. 1-V State, 1½ miles southwest of San Simon pool discovery in 7-22s-25e, encountered brackish water at 4,450-60 ft., and was abandoned.

OKLAHOMA

Carter Oil Co.'s Second Deep Test in Wilcox Sand

THE Carter Oil Co. 1 Johnson Ranch, SW NE 13-8n-4w, McClain County, recovered 5½ ft. of sand at 10,464-71 ft. The core consisted of 6 in. of white sand, a foot of soft shaley sand and about 4 ft. of tight, hard white sand. Operators were coring ahead at 10,462 ft. Top of the Wilcox in this test was tentatively called at 10,462 ft. The 1 Cottingham was drilling ahead below 10,960 ft. in hard green shale.

Hughes County.—Aladdin Petroleum Co.'s wildcat in SW NW 4-7n-10e, about 7 miles east of Holdenville, was completed for 27,000,000 cu. ft of gas in Cromwell sand at 3,494-98 ft. A spray of water accompanied the gas, which had a rock pressure of 1,400 lb., and it was plugged back from total depth of 3,634 ft. to 3,550 ft.

Lincoln County.—Two miles east of the Laffoon pool, Northern Ordnance 1 Long Commission, NW SW 12-13n-6e, made 5,775,000 cu. ft. of gas in Hunton at 4,086-93 ft.

Atoka County.—Northern Ordnance has made location for an 8,500-ft., or deeper, test southwest of Stringtown. This well, the 1 Fulton Ranch in SE SW SW 19-1s-12e, is located on what is known locally as the Knob Ridge. Previous tests in this area, which reported shows of oil in several sands, were mostly above 3,000 ft. Considerable interest is being shown in the test.

Washita County.—Gulf Oil Corp.

was reported to have made location for an outpost test at its West Sentinental Granite wash pool. The well is some 3 miles east of the 1 Hopkins, in SE SE 11-8n-20w, on Gulf's large east-west concentration.

OKLAHOMA WILDCAT COMPLETIONS

Hughes County: Aladdin Pet. 1 Austin, SW NW 4-7n-10e, 27,000,000 cu. ft. gas, Cromwell sand 3,494-98 ft., TD 3,634 ft.

Keener Oil & Gas 1-A Scott, NE NE NE 6-9n-10e, dry, TD 1,890 ft., sand 1,857 ft., with show of gas.

Lincoln County, 2 mi. E of Laffoon: Northern Ordnance 1 Long Comm., NW SW 12-13n-6e, 5,775,000 cu. ft. gas, Hunton 4,086-93 ft., 1,175 lb. RP.

Payne County: J. E. Crosbie 1 Gaunt, NE NE SE 15-18n-5e, dry, TD 3,855 ft., Wilcox 3,803 ft., second Wilcox 3,827 ft.

Berry et al 1 Gray, NW NE 35-19n-2e, dry, TD 4,119 ft., Layton 3,235 ft.

Seminole County: Winona Oil 1 Cade, NE NW SE 12-10n-7e, dry, TD 4,452 ft., Cromwell 3,586 ft., Wilcox 4,351 ft.

KANSAS

Ness County Discovery Is Completed

THE Arnold pool was opened in Ness County at the completion of Falcon-Seaboard Oil Co.'s 1 Frevely, SE SE 22-16-25w. Drilled to 4,562 ft., it made 1½ bbl. of water an hour but filled 700 ft. with oil when plugged back to 4,550 ft. and then swabbed 20 bbl. of oil an hour, 300 ft. off bottom. Initial potential was 142 bbl. a day from the Mississippi lime at 4,528-50 ft. A number of other wildcats were believed to be showing for discoveries.

Stafford County.—W. P. Faulkner 1 Cadman, a Shell Oil Co. farmout in SE SE NW 4-25-13w, is a Viola lime discovery that made a flow over the derrick when the plug was cracked. Oil rose 3,500 ft. in 6 hours and then flowed some 25 bbl. an hour. The oil is 38-gravity. Top of the lime was 4,041 ft. with total depth at 4,066 ft. On drill-stem test, open 20 minutes, 120 ft. of oil and 60 ft. of water were recovered. Location is south of St. John and north and west of the Leesburgh pool.

Barber County.—Sohio Petroleum Co. reported a show of oil in the Mississippi lime at its 1 Hull, NE NE 3-33-14w, 4 miles northwest of the Medicine Lodge gas field. Top of the Mississippi is 4,727 ft., with a soft and porous section at 4,748-95 ft. It is in this section that production is expected. Total depth is 5,152 ft. in Viola lime.

Barton County.—The Texas Co. 1 Harper, NW NW 10-18-14w, was being put on the pump after swabbing 13½ bbl. of oil an hour, natural, in Arbuckle lime at 3,438-44 ft. Five-inch casing was set to 3,440 ft. and the hole filled 2,000 ft. with oil in 3 hours, with no water. Location is 1¾ miles northwest of Cities Service Eveleigh

Financing
America's Oil
SINCE 1895

Look Ahead With First National

THE FIRST NATIONAL BANK
AND TRUST COMPANY OF TULSA

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

sand discovery at 3,299-3,311 ft.

KANSAS WILDCAT COMPLETIONS

Cowley County: Grallup, McNish 1 Dunn, NE NE SE 28-34-5e, pumped 10 bbl., Bartlesville 2,968-3,017 ft., TD 3,070 ft.

Continental 1 Davis, NW NW NE 3-34-6e, dry, TD 3,185 ft., Mississippi lime 3,078 ft.

Greenwood County: Bert Ash et al 1 Miller, NE NE SW 15-26-11e, dry, TD 1,918 ft., Bartlesville 1,871 ft.

Leavenworth County: Chas. Miller 1 Corbett, SE SW SE 23-9-21e, dry, TD 1,555 ft., Mississippi lime 1,395 ft.

Ness County: Falcon-Seaboard 1 Frevely, SE SE 22-16-25w, pumped 142 bbl., Mississippi lime 4,528-50 ft., TD 4,562 ft., discovery of Arnold pool.

Saline County: E. S. Adkins 1 Craig, SW SW NW 33-14-2w, dry, TD 3,448 ft., Mississippi lime 2,681 ft., Viola 3,259 ft., Simpson 3,389 ft.

Michigan Operators Protest Allowable Reduction

SAGINAW, Mich. — Protests of Michigan oil operators over the order of December 16 reducing the allowable withdrawal from wells in the Reed City field will be discussed by the state Conservation Commission at its next meeting February 14 and 15, according to P. J. Hoffmaster, state supervisor of wells, who had no immediate comment on the objections.

Hoffmaster issued the order on recommendations of state geologists who urged the reduction to conserve the field and cut down casinghead waste.

Nine companies joined in the protest, calling the order "burdensome, inequitable, unreasonable and unwarranted." Concerned are Ohio Oil Co., biggest operator, and these others: Pure, Gulf Refining, Gordon, Kirkman-Kalis, Bolger, McClanahan and C. L. Maguire.

The allowable protested is: From Monroe formation, 100 bbl. daily on 20-acre units, 175 bbl. on 40-acre units; Traverse formation, 125 and 218¾ bbl., respectively.

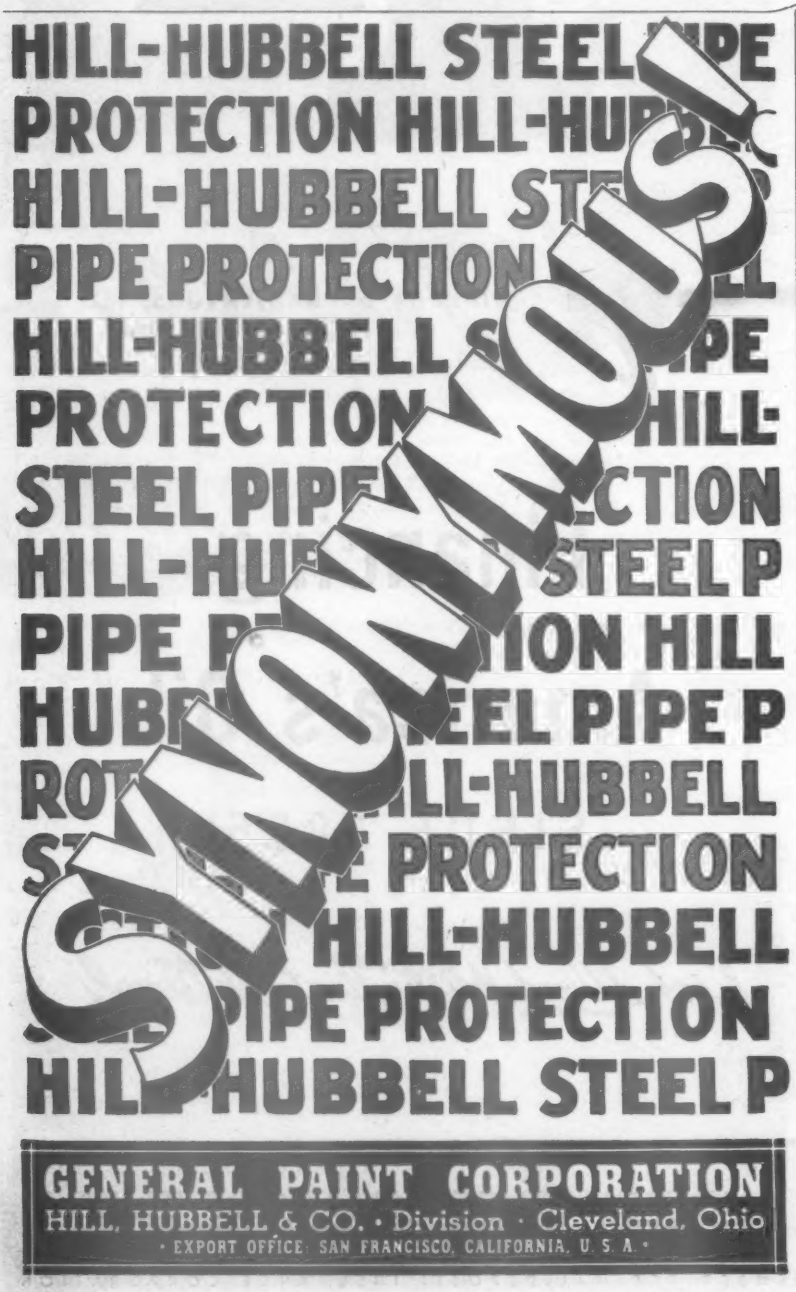
Shell Plans Sheridan Pool Cycling at Two Levels

HOUSTON, Tex.—Shell Oil Co., Inc., has presented to the Texas Railroad Commission a cycling program for the Sheridan field, Colorado County. The company plans to dual complete wells in the L sand and in the P-5 and Q sands combined. The L sand at 9,300 ft. is about 65 ft. thick and has a porosity of 18 per cent. It produces 3.2 gal. per 1,000 cu. ft. of gas. The lower sands, which are only about 50 ft. apart, would be produced as a unit, have a porosity of 13.5 per cent and yield about 1.7 gal. per 1,000 cu. ft.

Production Started at Enlarged Wyoming Plant

CHEYENNE, Wyo.—Continental Oil Co. natural-gasoline plant in the Lance Creek (Wyo.) field, which has been undergoing improvements and extensions to assist in the 100-octane aviation gasoline program, is now on stream after being shut down the past 2 weeks to make final connections.

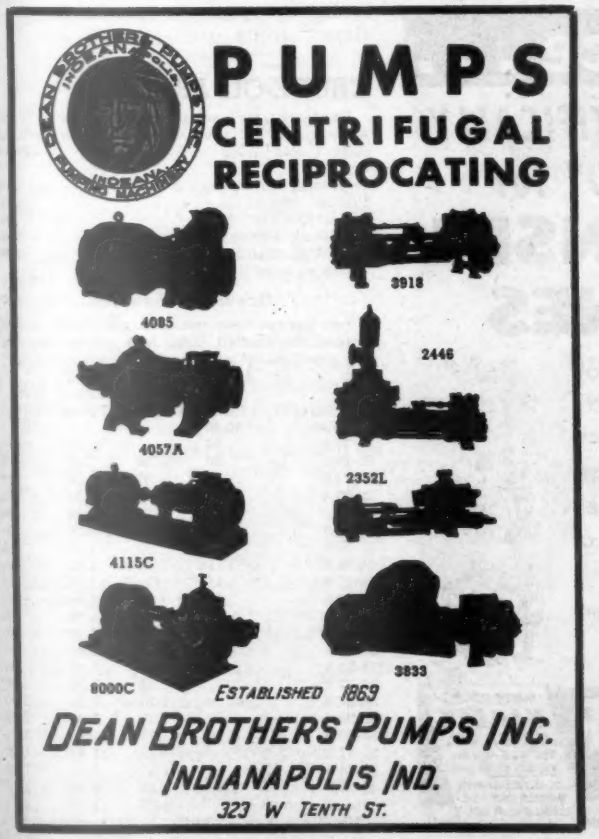
The capacity was increased from 25,000 to 100,000 gal. per day, primarily to furnish additional stock for the Frontier Refining Co. at Cheyenne and the Utah Oil Refining Co. at Salt Lake City. The principal improvements were designed to bring in the gas from the field at low pressure and make available light vapors which formerly were not utilized. The gas capacity was raised from 19,000,000 to 23,000,000 cu. ft. a day through these changes. The improvements cost in the neighborhood of $1,500,000.



LEGAL

U. S. DEPARTMENT OF AGRICULTURE, Farm Security Administration, Dallas, Texas. Sealed bids, in triplicate, will be received until 2:00 o'clock P.M. (cwt), Monday, March 20, 1944, and then publicly opened, offering bonus for operating rights in connection with oil and gas lease on 100 acres of land in Hidalgo County, McAllen, Texas, in which the Government owns all of the oil and gas mineral rights on the S½ of Lot 2 and all of Lot 5; and 31/32 of Lot 4. Award of lease will be made to bidder who can show sufficient experience and financial resources and prove citizenship. Interested parties may obtain bid documents, lease forms and operating regulations from the office of the Business Manager, Farm Security Administration, Parry Avenue at Commerce, Dallas, Texas.

EFCO
Specialists in designing and fabricating superior heat transfer equipment for 100-octane gasoline and synthetic rubber plants, and other plants where heat exchange problems must be correctly solved.
ENGINEERS & FABRICATORS, Inc.
P. O. BOX 7395
HOUSTON, TEXAS


PUMPS
CENTRIFUGAL
RECIPROCATING
4085
3918
4057A
2446
4115C
2352L
8000C
3833
ESTABLISHED 1869
DEAN BROTHERS PUMPS INC.
INDIANAPOLIS IND.
323 W TENTH ST.

SAVES MANPOWER!
Norris Clutch Type Valve Puller Eliminates Extra Pulling of Rods To Pull Lower Valve . . .
This is no time to *waste* precious manpower. This is an emergency that calls for the *conservation* of labor and the *saving* of time—and in pumping wells such a policy demands the use of the Norris Clutch Type Valve Puller. As part of your pumping string, this performance-proved device does *not* retard production or emulsify the oil. But it *is* ready at a moment's notice to pull the standing valve quickly, safely, positively, thus *saving* the extra run of the rods and the time and labor it involves. Desirable in peace, essential in war, it belongs in all pumping wells.
Norris Brothers, INC.
ROBINSON · ILLINOIS

JANUARY WELL COMPLETIONS SHOW SEASONAL SLUMP

	Comp.	Oil	Prod.	Gas	Dry	Under 1,000 ft.	1,000-2,500 ft.	2,500-5,000 ft.	5,000-10,000 ft.	Over 10,000 ft.	Footage	Rigs and drilling
Appalachian	274	269	309	3	2	1	215	57	1	0	694,042	286
Ohio	76	11	340	40	25	6	15	55	0	0	223,668	173
Indiana	25	12	574	1	12	7	11	7	0	0	44,304	49
Kentucky	62	20	3,009	16	26	6	49	7	0	0	140,693	157
Michigan	37	14	1,420	1	22	0	17	20	0	0	112,184	116
Illinois	131	78	17,109	0	53	4	48	79	0	0	344,910	204
Kansas	127	66	19,127	7	54	0	16	109	2	0	441,816	288
Nebraska	5	1	35	0	4	0	5	0	0	0	13,160	1
Missouri, Iowa	3	1	25	0	2	2	1	0	0	0	4,639	3
Oklahoma	75	38	19,896	9	28	5	24	31	14	1	362,837	362
North Texas	35	24	7,459	0	11	6	7	11	11	0	141,660	72
West Central Texas	31	8	5,451	1	22	9	9	13	0	0	66,666	16
West Texas*	101	81	31,663	0	20	1	9	63	28	0	430,232	151
Texas Panhandle	9	7	736	1	1	0	0	8	1	0	30,956	8
East Texas	25	8	2,896	0	17	1	0	2	22	0	155,382	33
Upper Gulf Coast	34	18	4,136	2	14	0	1	4	26	3	232,664	183
Lower Gulf Coast	47	20	3,754	3	24	0	1	2	44	0	304,701	136
South Central Texas	4	2	302	0	2	0	0	1	3	0	19,620	20
South Texas	29	10	1,212	2	17	2	5	11	11	0	116,316	72
Total Texas	315	178	57,609	9	128	19	32	115	146	3	1,497,617	699
Southeast New Mexico	21	9	2,191	1	11	1	3	14	3	0	73,056	30
Arkansas	14	6	2,200	0	8	0	4	3	7	0	64,819	47
North Louisiana	19	6	718	4	9	1	4	4	10	0	77,890	39
Louisiana Gulf	25	14	3,341	1	10	0	0	1	9	15	248,553	171
Mississippi	13	1	300	0	12	0	3	5	5	0	63,399	18
Montana	31	23	1,726	1	7	1	12	18	0	0	75,826	36
Wyoming	15	13	11,240	0	2	0	0	13	1	1	70,058	79
Colorado, Utah	2	1	25	0	1	0	0	2	0	0	8,315	12
Northwest New Mexico	2	1	15	1	0	2	0	0	0	0	1,516	13
California	148	122	21,810	3	23	8	52	60	25	3	500,044	213
Total January	1,420	894	163,019	97	439	63	511	600	223	23	4,963,246	3,076
Total December	1,726	937	183,847	203	597	91	564	763	289	19	5,801,863	2,899

*Does not include 233 input wells.

THE summary of operations for January reflects a sharp seasonal drop in total completions from December, with West Texas, South Texas, Montana, Wyoming and California showing substantial increases over December, counter to the trend in the rest of the country.

This downward trend may be expected to reverse itself shortly as the number of active operations indicated under rigs and drilling shows an increase over December. West Texas, upper and lower Texas Gulf Coast, Louisiana Gulf and South Texas show a substantial increase in activity, while the pace in California continues strong.

AIR in Abundance . . .

but it's SCIENTIFICALLY "RATIONED" for WISCONSIN ENGINES

The amount of air required for cooling the lower half of an engine cylinder won't do for the "business end", where the highly compressed fuel charge explodes. With a continuous, large-volume air-flow to draw from, Wisconsin engineers have long since figured out just how much air to *ration* to each section of the engine, for most efficient cooling.

This is important in relation to the satisfactory performance of *your* power-operated equipment.

Most H.P. per pound

WISCONSIN MOTOR Corporation

MILWAUKEE 14 WISCONSIN U S A

World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.

OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS

CRUDE-OIL PRICES

Representative selected crude prices from all sections of the country appear below:

East Texas	$1.25
Conroe	1.43
Tepetate, Louisiana	1.13
Illinois basin	1.37
Pecos County, Texas	.95
Bradford, Pennsylvania	3.09
Van, Van Zandt County, Texas*	1.08

*No change since 5-21-41.

Gravity Schedules

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Texas	West Texas*
18-18.9	$0.80	....	....	....
19-19.9	.84	....	$1.06	$0.70
20-20.9	.88	$0.85	1.08	.72
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	....	1.07	1.30	.94
32-32.9	....	1.09	1.32	.96
33-33.9	....	1.11	1.34	.98
34-34.9	....	1.13	1.36	1.00
35-35.9	....	1.15	1.38	1.02
36-36.9	....	1.17	1.40	1.04
37-37.9	....	1.19	1.42	1.06
38-38.9	....	1.21	1.44	1.08
39-39.9	....	1.23	1.46	1.10
40 and above	....	1.25	1.48	1.12

*Includes Lea County, New Mexico.

FOURTEEN OIL DISCOVERIES REPORTED LAST WEEK

	Week ended February 19, 1944					Cumulative total for 1944				
	Oil	Distillate	Gas	Dry	Total	Oil	Distillate	Gas	Dry	Total
Ohio	0	0	0	1	1	0	0	3	7	10
Indiana	0	0	0	0	0	0	0	0	3	3
Kentucky	0	0	0	0	0	0	0	0	10	10
Illinois	1	0	0	6	7	3	0	0	40	43
Michigan	0	0	0	6	6	1	0	0	28	29
Kansas	2	0	0	4	6	4	0	0	45	49
Nebraska-Missouri-Iowa	0	0	0	0	0	0	0	0	6	6
Oklahoma	0	0	2	4	6	4	0	3	23	30
Texas:										
North Central	1	0	0	7	8	6	0	0	43	49
West	1	0	0	3	4	5	0	0	20	25
Panhandle	0	0	0	0	0	0	0	0	1	1
East	0	0	0	3	3	0	0	0	23	23
Gulf Coast	3	0	0	7	10	10	3	2	31	46
Southwest	1	0	0	2	3	6	0	3	32	41
Total	6	0	0	22	28	27	3	5	150	185
Louisiana:										
North	1	0	0	0	1	1	0	0	4	5
Gulf Coast	0	1	0	1	2	1	3	0	10	14
Total	1	1	0	1	3	2	3	0	14	19
Arkansas	1	0	0	1	2	1	0	0	7	8
Mississippi and Southeast	1	0	0	0	1	3	0	0	14	17
Montana	1	0	0	0	1	1	0	0	2	3
Wyoming	0	0	0	0	0	0	0	0	2	2
Colorado, Utah	0	0	0	1	1	1	0	0	2	3
New Mexico	0	0	0	3	3	0	0	0	9	9
California	1	0	0	1	2	1	0	3	18	22
Total United States	14	1	2	50	67	48	6	14	360	448
Total previous week	6	1	4	57	68					

LA.-ARK.

Union County Wildcat Sets Pipe for Test

SHREVEPORT, La.—Lion Oil Refining Co.'s wildcat in Union County, Arkansas, was ready to test an oil sand after setting casing to total depth of 7,415 ft. Location of the well, in 20-18s-17w, is approximately a 1-mile extension on the southern side of the Schuler field.

Northwest of Schuler, Atlantic Refining Co.'s Wilks pool discovery was completed for 100 bbl. of oil in the Smackover lime at 7,861-63 ft. Previously operators had trouble with water entruding. The well first flowed at the rate of 75 bbl. of oil daily, including 10 per cent salt water. On a 16-hour test it flowed 85 bbl. of oil and 113 bbl. of water through ¼-in. choke. A squeeze job is reported to have shut off most of the water. Atlantic has obtained permit to drill the 2 Murphy as a northwest offset in SE NW 3-18s-18e.

Tensas Parish. — Chicago Mill & Lumber Co.'s Wilcox discovery northwest of the Holly Ridge pool was completed at 90 bbl. of oil in the sand at 3,012-24 ft.

ARKANSAS WILDCAT COMPLETIONS

Ouachita County: Garland Anthony 1 Shankle, SW SE SE 33-12s-18w, dry, TD 3,256 ft.

Union County: Atlantic Ref. Co. 1 Murphy Lans Co., NW SW 2-18s-18w, flowed 100 bbl., Smackover lime 7,861-63 ft., TD 7,942 ft., discovery of Wilks pool.

NORTH LOUISIANA WILDCAT COMPLETIONS

Tensas Parish: Chicago Mill & Lumber Co. 1 Mutual, NE SE 12-11n-9e, flowed 90 bbl., Wilcox 3,012-24 ft., TD 8,463 ft.

Ohio State Professor Made Compact Research Member

Edward V. O'Rourke, professor of mining and petroleum engineering at Ohio State University, Columbus, has

E. V. O'ROURKE

been appointed by Gov. Andrew F. Schoeppel, of Kansas, chairman of Interstate Oil Compact Commission, as Ohio's member of the Research and Coordinating Committee.

Professor O'Rourke graduated in mining engineering at Ohio State in 1919. He spent a year with Braden Copper Co. as a mining engineer in Chile, another year in Venezuela with Maracaibo Oil Exploration Corp. and a third year in Venezuela with Gulf Oil Corp. In 1925 he became an instructor at Ohio State, first as assistant professor, later as associate professor, and then professor. He organized a 4-year curriculum dealing with petroleum and natural gas.

In summer months Professor O'Rourke acquired field experience in the petroleum industry, making repressuring experiments and studying oil-production methods, secondary oil recovery, and estimations of oil reserves. He has done research and consulting work for Phillips Petroleum Co. and Shell Oil Co., Inc., and has been active in a consulting capacity for many companies. He is a member of the A.I.M.E. and A.P.I.

Temporary Priority Granted On Tank-Truck Tractors

WASHINGTON, D. C.—On request of Office of Defense Transportation, War Production Board has granted a temporary priority on all tank-truck tractor applications that are approved by the ODT. All tank-truck tractor applications approved during the current petroleum transportation emergency will be handled by the truck manufacturers ahead of other truck applications.

Joseph B. Eastman, director of ODT, said the action was in accordance with the previously announced policy of doing everything possible to speed movement of oil to the armed forces, the East Coast and elsewhere.

PROVED
IN PEACE—IN WAR

'BESTOLIFE Lead Seal Joint Compound has been used successfully in the Oil and Refining industries for the past fifteen years. During that time, it has proved itself superior in protecting threads and in providing tight joints which can be broken out easily.

Today, 'BESTOLIFE has enlisted in the Navy, Merchant Marine and Defense Plants for the duration, and we are proud of this assignment to help in the Victory effort.

But there are still ample stocks of 'BESTOLIFE available on any priority rating, at supply house field stores in every drilling district in the United States and Canada. Use 'BESTOLIFE Tool Joint Compounds for best results!

MANUFACTURED BY

I. H. GRANCELL
1601 EAST NADEAU STREET
LOS ANGELES 1, CALIFORNIA

BUILD FOR
VICTORY *with*
DEVIL DOG No. 4

No. 4 Devil Dog A. P. I. 4

YOUR service records will show that Jeffrey's 85 years of chain-building experience makes this the superior chain both in war and peace.

THE JEFFREY MFG. CO.
891-99 N. FOURTH ST., COLUMBUS, O.
Texas Sales Office: 6358 Auden St., Houston

Among the

Drilling Contractors

Luling Oil & Gas Co., San Antonio, Tex., has derrick up at H. B. Zachry Co. 1 Page estate, in the West Cowden area of Bee County, in B. Q. Hadley Survey A-198. This test is 1,100 ft, southwest of Zachry 1 Brown discovery, and is a 4,000-ft. test.

J. W. Gorman, San Antonio, Tex., contractor on American Republics Corp. 1 M. I. Richardson, wildcat in H&GN Survey 18, A-1,781, 12 miles northwest of San Diego, Duval County, Texas, spudded last week, set 10¾-in. at 106 ft. and drilled ahead below 1,500 ft.

Can-Tex Drilling Co. of Calgary, Alta., has contracts from Dominion Oils for two wells, one in the Grassy Lake area and the other near Foremost, in southern Alberta.

Morris-Hamilton, Houston, Tex., has contract for Union Oil Co. of California 20-G M. Gray, 34-10s-12w, Vinton field of Calcasieu Parish, Louisiana. Proposed depth is 6,500 ft.

M. L. Massingill, San Antonio, Tex., has contract to drill The Texas Co. 3-B Armstrong et al in the Armstrong field of Jim Hogg County, Texas, and is preparing to move in rig. It is a 5,000-ft. test, 1,800 ft. southwest of the 1-B Armstrong, a southwest extension well.

E. & H. Drilling Co., San Antonio, Tex., will drill Guy E. Green et al 2 Ida P. Huggins, in Maria de Jesus Ybarbo Grant A-50, 3½ miles east of Goliad in Goliad County, Texas. It is a 4,500-ft. test. Rig is on location.

Newman Bros., San Antonio, Tex., is rigging up for Sun Oil Co. 10 Weil in the Weil field of Jim Hogg County, Texas. This test is on Block 4, Palitos Blancos Grant, and is contracted to 6,000 ft.

Goldus Drilling Co., Houston, Tex., has contract for Highland Oil Co. 1 Joe Seiler, a wildcat in LaVaca Grant, Share 2, 2½ miles southwest of Alice, Jim Wells County, Texas. Rig is being installed at the location for a 5,000-ft. test.

T. G. & M. Drilling Co. is rigging up at Arkansas Fuel Oil Co. 1-B E. E.

Crew of Manning & Brown, drilling contractors, in Elk Basin field, Park County, Wyoming. The men are: S. M. Bailey, A. C. Scott, M. M. Brown, assistant tool pusher; H. Cockburn, tool pusher; Ed Ficken, E. Grooms, and Steele White, who is with Sinclair Wyoming Oil Co.

Lyons, in D. C. Lyons, Jr., Survey A-382, 1,155 ft. northwest of the discovery well in the Runge field, Karnes County, Texas. This is an 8,000-ft. Wilcox test.

Weigand Bros., San Antonio, Tex., has been awarded contract to drill Sohio Producing Co. 1 Sanchez, a wildcat in the northwest corner of H&OB Survey 1,146, 3½ miles northwest of Encinal in Webb County, Texas.

O. W. Dyer, Houston, Tex., is the contractor to drill Gulf Refining Co. 8-A Shlicher-Thomas, Tract 1, Pine Prairie field of Evangeline Parish, Louisiana. This test, NE 3-4s-1w, is to explore Wilcox on the south flank of the dome.

Union Drilling Co. is the drilling contractor on Ide Oil & Gas Corp. A-1 State-Goodwell, in C E½ SE SW 8-14n-11w, Newaygo County, Michigan.

Markley-Bankhead, Houston, Tex., has contract to drill Ohio Oil Co. 1 Fred O. Piker, new test in the Hope Villa area of East Baton Rouge Parish, Louisiana, in 1-8s-2e. It will be drilled to 9,600 ft.

P. K. DeGenther will drill on his own account the P. K. DeGenther 1 Mable Bonner, in SW SW SE 6-7n-13w, Ottawa County, Michigan.

Max Spidel is the drilling contractor on the Raymond Donnersberger 1 R. and I. FitzRoy, in NE SE SW 20-2s-16w, Van Buren County, Michigan.

Noble Drilling Co., Ardmore, Okla., is the contractor for Magnolia Petroleum Co. and J. S. Abercrombie Co. to drill the 1 Adam Doiron et al at East Hackberry in Cameron Parish. The test is 1,665.3 ft. south and 1,039.3 ft. east of southeast corner of Section 13-12s-10w, but in Section 46-12s-9w. It is an Oligocene test.

Regan Drilling Co., Lafayette, La., is contractor to drill R. R. Frankel et al 1 Lillian La Pice, a new test in the La Pice field of St. James Parish, Louisiana, in 37-12s-15e. Contract depth is 10,500 ft.

A. R. Coutts of Yorkton, Saskatchewan, has received contract for drilling two wells. Yorkton 1, NW 11-26-4w2, standing at 730 ft. will be completed for W. E. Clark of Wolseley, Sask., and 1 Portage, SW 9-12-7w1, will be drilled for D. J. Coyle of Winnipeg, Man.

American Drilling Co. has been awarded the drilling contract on Bert Baker, John Hancock and W. B. Stewart A-1 State-Adams, in NW SW NW 2-19n-3e, Arenac County, Michigan.

Union Rotary Corp. will drill two tests in Michigan. These are the Cities Service Oil Co. B-1 Otto Methner, in NW SE NW 33-16n-3w, Isabella County, and the Sun Oil Co. 1 Ray E. Loop, in C S½ NE SE 1-18n-10w, Osceola County.

Ashby Drilling Co. is the contractor on the Gulf Refining Co. 2 Don Compson, in C S½ SE NW 6-16n-7w, Mecosta County, Michigan.

Gordon Oil Co. is the contractor on Smith Petroleum Co. and Gulf Refining Co. 2 Carpenter-Compson (Comm.), in C S½ NE SW 6-16n-7w, Mecosta County, Michigan.

Well established organization with experienced personnel and warehouse facilities located at Houston, Odessa, Kilgore, Texas, and Lake Charles, La., is interested in representing Production and Service accounts in these areas. We are in position to render a real service and invite your inquiries. Address c/o Oil & Gas Journal, Tulsa, Oklahoma. Box C-150.

Unibolt
"FLEXI-BALL JOINT"
Clearing house for contraction and expansion in steam lines.
THORNHILL-CRAVER COMPANY
HOUSTON

DEPENDABLE
SISK'S
SUPER-GRIP
Combination 1⅛-1¼
Polish Rod Clamps
are built to give all the grip four bolts can muster.
And grease and dirt on the rod don't make **SUPER-GRIP** slide.
Competitive price.
Ask your supply store for **SUPER-GRIP Polish Rod Clamps.**
The SISK Co.,
3105 Miami St.,
Wichita Falls, Tex.
IF IT'S MADE BY SISK, IT'S BETTER

Assembled Liner
Reduced Size

100% HARDNESS UNIFORMITY

is assured with MacClatchie "Money-Saver" Pump Liners . . . Every liner must pass rigid testing method covering entire inner surface, which reveals any soft spots that would cause breakdown and premature wear.

Uniform wall thickness on all "Money-Savers"—including reduced sizes—lowers handling weight . . . saves money on export shipments. Wear-free gland can be used over again—you need buy only the liner itself when renewing "Money-Savers." QUALITY is the reason more MacClatchie Liners are in use today than any others!

Write for Descriptive Literature

MacCLATCHIE MANUFACTURING CO.
COMPTON, CALIFORNIA
Mid-Continent Distributor:
HAKE TOOL COMPANY, Houston, Texas
Rocky Mountain Representative:
MOUNTAIN SALES & SERVICE CO.,
Casper, Wyoming
Foreign:
GEORGE R. WOODS, 17 Battery Place, New York, N. Y.

FOR SALE

GAS ENGINE—
150 HP, 200 RPM
Generator—112 KVA, 240 V, 200 RPM
Generator Exciter—DC, 8 KW
Synchronous Starter—112 KVA
One-panel switchboard
Circuit Breaker—330 Amp., 220 V.

RAILROAD CARS
2 RR Passenger Cars—Bunk, 14 men
1 RR Passenger Car—Diner
1 RR Passenger Car—Diner or Recreation
1 RR Refrigerator Car—2 compressors

And OTHER MISCELLANEOUS EQUIPMENT

A. R. Hebenstreit
Ph. 4544, Albuquerque, New Mexico
or write
NEW MEXICO CONSTRUCTION COMPANY, Inc.,
P. O. Box 592
Albuquerque New Mexico

PERSONALS

JOHN S. BELL

East Texas Chairman Of A.I.M.E. Began As Roughneck

JOHN S. BELL, new chairman of the East Texas section of American Institute of Mining and Metallurgical Engineers, has been division petroleum engineer for Humble Oil & Refining Co. in its East Texas division since July 1941. He began his service with Humble in 1933. He had graduated in petroleum engineering from University of Oklahoma and was entitled to write "B.S." after his name if he wanted to—which he didn't.

Bell accepted the old-fashioned axiom that starting at the bottom confers certain marked advantages later in one's career, and he took a job as roughneck in Humble's Gulf Coast division. Soon afterward he was moved to the petroleum engineering department. He was in the Southwest Texas division from March 1934 until February 1938 when he was appointed division petroleum engineer in the North Texas division, with headquarters in Wichita Falls. He remained there till he was transferred to his present post in East Texas, with headquarters in Tyler.

Since 1939 Bell has been active in the affairs of A.I.M.E. As chairman of the East Texas section he succeeds R. W. Erwin, also of Tyler. The section includes Dallas and North Louisiana.

William Loucks, chairman of the board, and **James A. Dunn,** president, of Barnsdall Oil Co. are making a tour of California fields in company with **William C. Whaley,** vice president and in charge of Pacific Coast operations.

L. B. Jackson, independent oil operator of Tulsa, was elected chairman of First National Bank & Trust Co., Oklahoma City, Okla., last week in a reorganization necessitated by the recent death of W. E. Hightower, president, in an airplane accident.

Morris A. Peterson, geologist, and **David R. Teel,** field drilling and production superintendent for United Gas Pipe Line Co. in its Shreveport, La., district, have been transferred to the Monroe, La., district. **Andrew J. Clyburn,** switcher in the Shreveport district, was transferred to the Monroe district as field drilling and production superintendent. **Thomas J. Talley,** gasoline-plant operator in the Shreveport district, was shifted to the Houston, Tex., district as dehydration-plant attendant.

John L. Foster, Cities Service Oil Co. scout at Mattoon, Ill., has been transferred to Casper, Wyo., as district geological scout.

D. R. Snow, vice president, Tulsa, and **Carl Richardson,** in charge of the Houston office of the Barnsdall Oil Co.; **T. N. Law,** president of the Falcon Seaboard Drilling Co., Tulsa; **S. A. Swensrud,** vice president of The Standard Oil Co. of Ohio, Cleveland, Ohio, and **John C. Smoots,** in charge of exploration for the Sohio Oil Co., Cleveland, have returned from a trip to Venezuela. Plans of the companies in regard to oil operations in Venezuela are indefinite.

Hewlett A. Russell has resigned as geologist for Standard Oil Co. of Texas to become an independent operator, with headquarters in Graham, Tex.

Lucien F. Craig has resigned as assistant director of the Division of Petroleum Supply, Petroleum Administration for War. That division has been incorporated in the newly formed Supply and Transportation Division. Craig obtained leave from his post as assistant general manager of Gulf Oil Corp. to join the PAW staff in March 1943.

John W. Thomas, manager of Deep Oil Development Co., Wichita Falls, Tex., has been chosen president of North Texas Oil and Gas Association. **Eddie Kadane** was elected to succeed Thomas as vice president, and **Fred Sehman** was elected to his third term as executive vice president.

Roy L. Brecke, for many years secretary of Wisconsin Petroleum Association, has resigned that post. He is now secretary to Governor Goodland.

B. I. Graves, vice president of Tide Water Associated Oil Co., has been named chairman of the product conservation committee, Petroleum Industry War Council, which is planning a campaign to educate the public concerning the oil shortage.

A. L. SOLLIDAY

A. L. Solliday has been elected vice president in charge of operations and a member of the board of Stanolind Oil & Gas Co., Tulsa. He was formerly manager of the exploration department. **George W. Clarke,** assistant manager of the exploration, has been promoted to succeed Solliday as

G. W. CLARKE

J. G. BARTRAM

head of the department and **J. G. Bartram,** geologist in the central office, becomes assistant to Clarke.

S. B. Bean has been made operating superintendent of the Bayou Pipe Line System, with headquarters at Port Neches, Tex. He will supervise operations between the Trinity and Calcasieu rivers. **C. P. Wilson** has been made foreman of the Baytown, Tex., district and **H. E. White** foreman of the Opelousas, La., district.

Clarence A. Wiggins and **George I. McFerron,** formerly president and vice president respectively of Adams

You'll like the hospitality you find at The BLACKSTONE in Fort Worth

Enjoy superb food in the Dining Room and Coffee Shop. Owned and managed by Texans

The BLACKSTONE
FORT WORTH'S HOTEL OF DISTINCTION
JOE T. O'KEEFE, *President*

Oil & Gas Co., have formed Wiggins & McFerron Oil Co., which will conduct leasing, exploration, seismograph and drilling operations, with headquarters in Houston, Tex. Holdings of Adams Oil & Gas Co. were disposed of recently to Pan American Production Co. and Standard Oil Co. of Ohio.

C. D. Winkelman, who was superintendent of the Bayou pipe line system, has been made superintendent of the Texas Gulf area for Shell Pipe Line Corp., succeeding **L. F. Young,** who recently was assigned to the Cushing, Okla., headquarters as superintendent of the Mid-Continent area. **C. G. Billings** has been made assistant superintendent of the Mid-Continent area, taking the place of **W. N. LeSeuer,** who is now general maintenance superintendent. **E. A. Dierdorff,** who was area engineer, has been advanced to the head office organization and he is succeeded by **C. E. Delhonde,** project engineer during construction of the Bayou system. **W. H. Craddock,** formerly superintendent of the Louisiana division of the Bayou system, has been made superintendent of Shell's Healdton, Okla., division. **W. B. Sanders** is superintendent of Shell's Cushing-Wood River division. **I. C. Murphy** became foreman of the Cushing district. **U. W. Clark,** formerly assistant area chief dispatcher, is promoted to chief dispatcher, succeeding **V. J. Jones,** who gave up the post on account of illness. **E. F. Gates** succeeds Clark as assistant.

C. H. Fidler, landman, is in charge of an office which Tide Water Associated Oil Co. has established in Jackson, Miss.

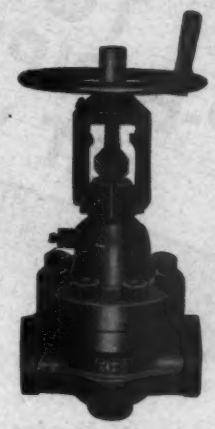
Karl B. Jauman, formerly with Attock Oil Co., Ltd., in India, and later employed in installing the naval base at Trinidad, British West Indies, was a speaker at a recent meeting of the Los Angeles, Calif., chapter of Nomads. He discussed the Canol project in Alaska, where he recently was in the service of one of the contracting companies.

C. A. Johnson, of Socal Oil & Refining Co., was elected president and **Henry Brown** of Operators Oil & Refining Co. and **B. E. Devere** of Pathfinder Petroleum Co. were elected vice presidents at the eighth annual meeting of the Independent Refiners Association of California. **A. M. Lockhart** of Envoy Petroleum Co. was elected secretary-treasurer of the association.

S. M. Griffith, A. F. Brough, C. W. Powell, G. R. Daley and **J. R. Keane** were reelected directors of the Western Asphalt Association at the organization's annual meeting held recently in Los Angeles, Calif.

ORBIT VALVES

ARE BUILT TO "TAKE IT"



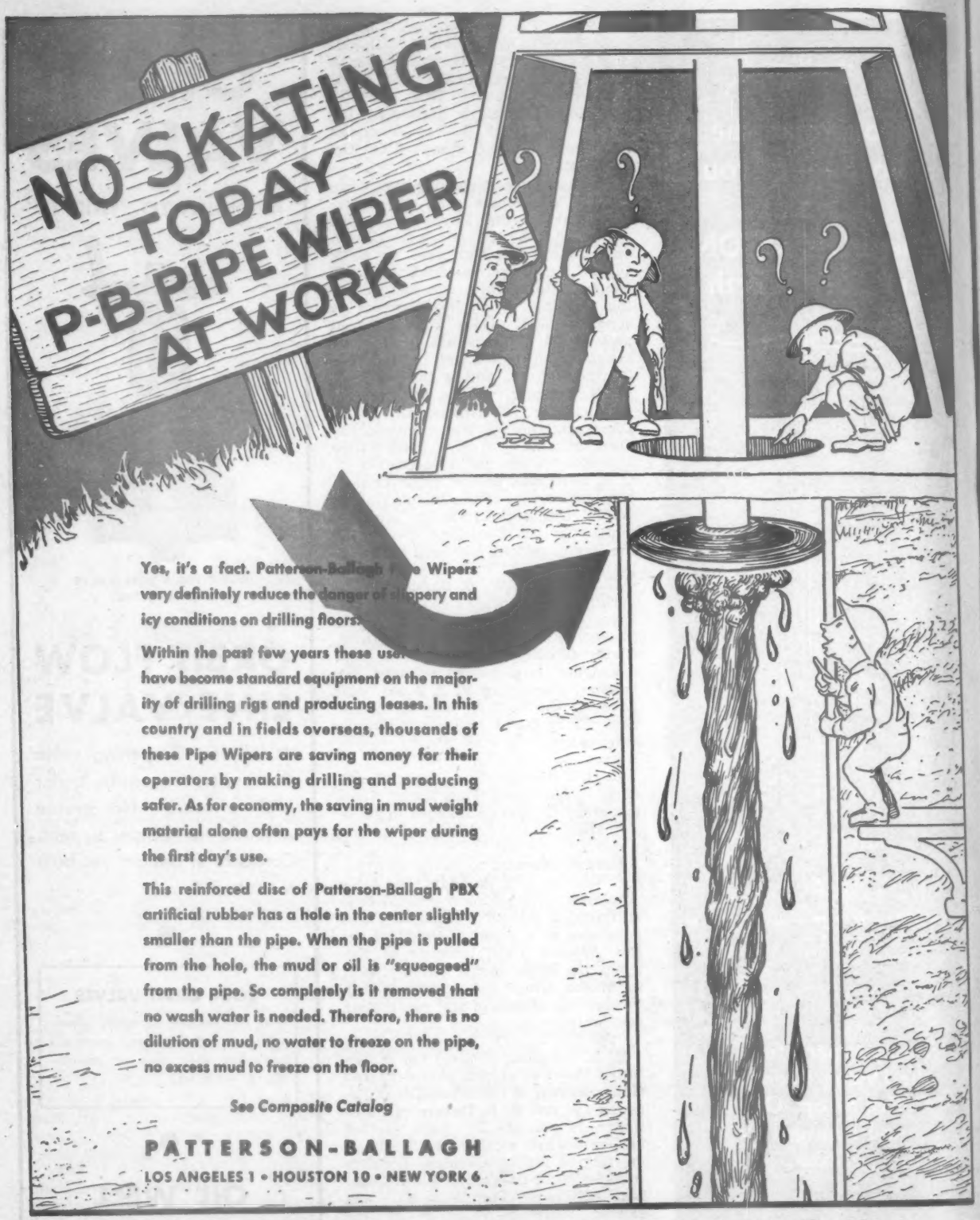
ORBIT FLOW LINE VALVE
(Screwed End)

ORBIT FLOW LINE VALVE

A full round opening valve that operates easily under high pressures. No grease required to effect a seal. Compact in design, yet built to "take it."

YOUR ORBIT VALVES will last for the duration. Meanwhile, if you have any questions regarding their care or maintenance, write us.

OIL WELL IMPROVEMENTS CO.
Since 1912
TULSA, OKLAHOMA



Yes, it's a fact. Patterson-Ballagh Pipe Wipers very definitely reduce the danger of slippery and icy conditions on drilling floors.

Within the past few years these useful [illegible] have become standard equipment on the majority of drilling rigs and producing leases. In this country and in fields overseas, thousands of these Pipe Wipers are saving money for their operators by making drilling and producing safer. As for economy, the saving in mud weight material alone often pays for the wiper during the first day's use.

This reinforced disc of Patterson-Ballagh PBX artificial rubber has a hole in the center slightly smaller than the pipe. When the pipe is pulled from the hole, the mud or oil is "squeegeed" from the pipe. So completely is it removed that no wash water is needed. Therefore, there is no dilution of mud, no water to freeze on the pipe, no excess mud to freeze on the floor.

See Composite Catalog

PATTERSON-BALLAGH

LOS ANGELES 1 • HOUSTON 10 • NEW YORK 6

PATTERSON-BALLAGH

PIPE WIPERS

Market Developments

CONTINUED accumulation of crude oil in storage tanks of Gulf Coast refining companies indicates that downward adjustments of production schedules may be necessary before additional pipe-line facilities now under construction become available for service. Stocks of crude oil originating in Texas have risen nearly 12,000,000 bbl. since early October, a rate of approximately 100,000 bbl. daily.

Two reasons stand out for the rise in crude-oil inventories at Texas and Louisiana Gulf Coast terminals when other parts of the country are critically short, particularly the interior refining states in District 2. First, there was a natural reaction in the rail movement of crude and oil products when the first big-inch line was completed. Second, many of the war-product plants on the Gulf Coast have been delayed in completion because of manpower and equipment shortages, forcing deferment in peak crude-oil requirements. This failure of production schedules to mesh with the refinery construction program has resulted in a temporary maladjustment which, plant operators believe, will be corrected during the second half of 1944 and possibly during the second and third quarters.

Buyers of Texas crude oil have sought an adjustment in PAW production quotas to compensate for the lag in completion of new refining facilities. Contributing to the current unbalanced relation of production to refinery demand in District 3 is a reduction in the coastwise movement of tankers and rigid limitation on the number of tank cars available for overland rail shipments.

Supply indices which the American Petroleum Institute has been releasing weekly in one form or another for more than a year were discontinued last week, thus depriving the industry of the only existing base for evaluating the position of the important East Coast area. The reason for the action was not given.

Recently the index conflicted with statements emanating from Washington. Again last week Petroleum Administrator Ickes issued a warning on heating-oil consumption.

Actually, the index for gas oil and distillate fuel on the East Coast stood at 92.2 for February 5. Stocks as of that date were 92.2 per cent of the 1940-41 average. With less than 2 months of the heating-oil season remaining and with rationing in effect, this volume should be ample to carry through if deliveries were maintained at anything like recent rates. The only alternative, and it is indicated by Ickes' attitude, is that the deliveries will drop markedly in the near future.

Snowstorms throughout much of District 2 impeded motor travel to such a degree that a slight slackening was reported by Middle West refiners in the call for gasoline.

Demand for kerosene from the East Coast continued to be insistent. In compliance with a PAW request, refiners were doing their utmost to move kerosene and burning oils to the Atlantic seaboard, but shortage of tank cars interfered.

Demand for natural gasoline exceeded the supply, but manufacturers said they were taking care of needs fairly well by apportioning shipments in accordance with the urgency of buyers' requirements.

A.P.I. Refinery Report

Week Ended February 12, 1944

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gasoline	Stocks: Residual	Stocks: Gas oil
Appalachian	141	3,270	381	993
Ind., Ill., Ky.	754	17,879	3,013	5,665
Okla., Kan., Mo.	357	7,844	1,248	1,720
Censored area*	2,081	36,060	15,088	16,755
Rockies	98	1,873	597	375
California	797	15,396	32,126	9,436
Total 2-12-44	4,228	82,322	52,453	34,854
Total 2- 5-44	4,324	81,784	52,734	36,023
Total 2-13-43	3,569	91,758	70,815	35,888

*Reports combined on East Coast, Texas Gulf Coast, Louisiana-Arkansas and Inland Texas at request of PAW.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
February 12, 1944	238,206,000
February 5, 1944	†237,745,000
February 13, 1943	234,239,000

*Excludes unrefinable stocks in California. †Revised.

REFINERY PRICE SUMMARY

(Prices as of February 22, 1944)

Quotations are f.o.b. plant in cars and in cents per gallon except where otherwise noted. They are exclusive of the federal excise taxes of 1.5 cents a gallon on gasoline and 4.5 cents a gallon on lubricating oils, and do not include marine lighterage charges.

REFINERY GASOLINE

Octane (A.S.T.M.):	80†	72-74	68-70	63-66
Mid-Continent*	‡6.00-6.25	5.750-6.000	.....	5.625
Gulf Coast	6.00-6.50	§5.750-6.250	§5.750-6.250	§5.250-5.750
Northeast Coast	9.80	9.2	9.2	.....
California	.....	6.255-6.500	5.750-6.125	5.125-5.500

*Basis Group 3. †1939 C.F.R. (research method). ‡Inland Texas and adjoining counties in Arkansas and North Louisiana. §Unleaded.

KEROSENE AND DISTILLATE FUEL OIL

Product:	Kerosene†	No. 2	No. 3	No. 5	No. 6‡
Mid-Continent*	4.125-4.375	3.500-3.625	3.375-3.500	§0.85	§0.80-1.27
North Louisiana*	4.125-4.375	3.500-3.625	.....	.....	0.80-1.27
Pennsylvania	6.000-6.125	5.875-6.125	5.875-6.000	.....	.....
California	4.500-5.500	5.500	5.500	§1.10-1.25	§1.10-1.15
Northeast Coast	6.800	6.700	6.700	1.95	1.65
Gulf Coast	4.125	3.750-3.875	.....	1.35	0.85

*Reflecting OPA ceilings, depending on destination of shipments. †Quotations for 41-43 gravity. ‡Range depends on gravity. §Pacific Specification 300. ¶Pacific Specification 400.

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	4.750	5.700
North Texas	4.375	5.250
North Louisiana	4.375	5.250
California	4.875	5.500

LUBRICANTS

PENNSYLVANIA GRADE—	
Bright stock,* 10 pour point	30.5
Bright stock,* 25 pour point	25.0
Steam refined, 600	15.0
Neutral oil,† 10 pour point	34.0
Neutral oil,† 25 pour point	28-32.5

*No. 8 color, 145-155 at 210, 540-550 flash. †150 vis. at 70° F., 3 color, 400-405 flash.

MID-CONTINENT—	
Bright stock, 150-160 D, 0-10	23.00
Neutral oil,‡ 200-3	15.00

‡0 to 10 pour point.

GULF COAST—	
Pale oil, 200-3	8.75
Pale oil, 500-3½	10.00

WAX

Oklahoma, 124-126, w.c.s.	4.250
Pennsylvania, 122-124, w.c.s.	4.250
NEW YORK (in bags)—	
Refined, 130-132 (A.m.p.)	7.00
Crude, 124-126 (W.s.)	6.00

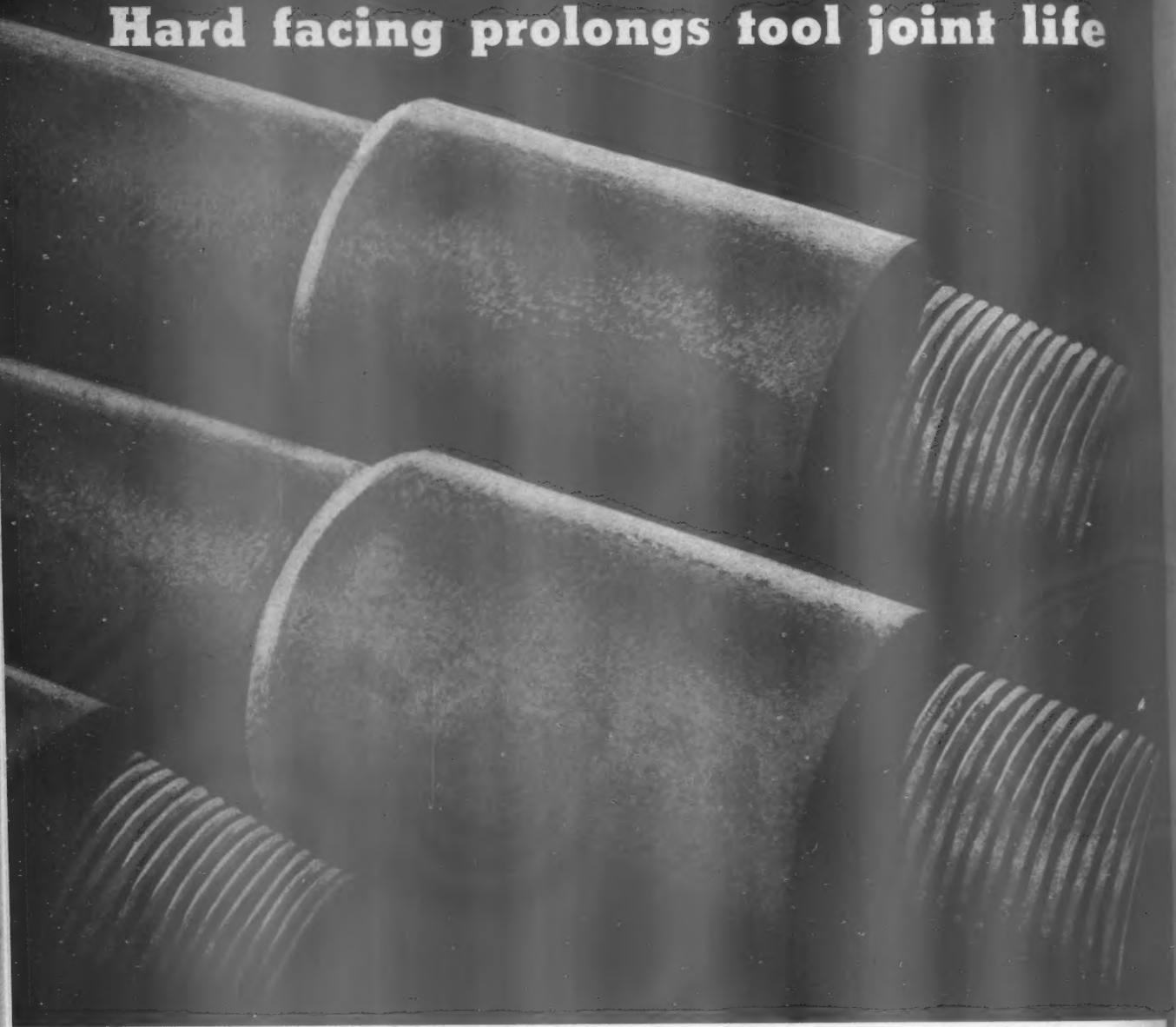
TANK-WAGON PRICES

(Gasoline prices based on regular grades in cents per gallon.)

	Dealer tank wag.	Combined tax	Kero. tank wag.
Baltimore, Md.	15.95	5.5	10.5
New York	16.10	5.5	10.1
Philadelphia	16.20	5.5	11.9
Washington, D. C.	15.20	4.5	11.3
Chicago	14.10	4.5	10.6
Cleveland, Ohio	14.50	5.5	*9.0
Atlanta, Ga.	18.90	7.5	*11.5
Denver, Colo.	14.50	5.5	11.0
San Francisco	14.50	4.5	11.5
Tulsa	16.50	7.0	8.5

*Includes 1-cent state tax.

Hard facing prolongs tool joint life



Information supplied by the "Oil and Gas Journal"

Two prominent causes of tool joint wear are contact with hard, abrasive formations in the hole and erosion from the mud stream. Wear from either cause weakens the joint at the pipe screw end, and reduces shoulders to the point that elevators cannot engage them securely.

Hard facing has proved one effective means of combatting either contact or erosion wear. Good practice consists of applying a band or two of hard facing material at the place where the wear is most severe.

This method affords the desired protection, but still leaves a soft surface for the gripping action of the tongs used to make up or break out joints.

The material used for hard facing should be as hard as possible; certainly harder than any formation likely to be encountered in drilling. It has been found that even a slight variation in the hardness of the facing material will make a marked difference in the degree of protection provided.

Hard facing is best done in a well-equipped machine shop, and by an operator who is skilled at the work. Otherwise the results are likely to be more harmful than good.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company

500 Fifth Avenue · New York City

MOLY

Equipment Progress

Depthometer for Stringing-In Measuring by Cavins

Designed to measure quickly and accurately the actual depth of oil and gas wells, at all times and under all conditions on both rotary and cable-tool rigs, the new Cavins Depthometer, manufactured by Cavins Co., 2835 Cherry Avenue, Long Beach, Calif., utilizes the "friction" principle,

but the method of application is said to be entirely different from that of other mechanical devices. The main wheel is held tightly against the line by tension arms, and this uniform contact causes positive rotation of the wheel, so that the possibility of human error has been practically eliminated.

The device provides accurate measurements when used on all sizes from ¼ in. to 1⅛ in. It will record accurately the depth position of the tool at all times, and will automatically compensate for any raising of the tools, as might happen when feeling for a pickup, or similar operation.

Trade Literature

Wall-Colmonoy Corp., 720 Fisher Building, Detroit, Mich.—Catalog No. 75, an eight-page folder on the company's line of hard facing alloys and overlay metals.

New York Belting & Packing Co., 1 Market Street, Passaic, N. J.—"Facts About Synthetic Rubber," a 32-page illustrated booklet which gives an over-all picture of the history of synthetic rubber and some fundamental facts about its production. It covers the five general commercial types and explains the characteristics which make each particularly adaptable to specific services.

Glu-Weld Stands Up Well in Rough Service

Union Paste Co., Hyde Park., Mass., recently heard a story involving one of its products, Glu-Weld, which is used as a water-resistant adhesive for sealing waterproof paper-bag liners in conformance with various government specifications which require such liners for overseas shipments.

A spokesman for a U. S. Government arsenal in the East recently stated:

"We recently had returned to us from the African theater a shipment of material which we had sent across some few months ago. All of this material had been packaged in our own field service warehouse. Examination of the packaging of the material showed that despite the rough handling involved in shipment by rail to a port of embarkation; shipment by sea; the carrying inland of the containers by truck; and despite the extreme weather conditions to which the packages were submitted in outdoor storage, as well as the same conditions upon the return trip, the waterproof bag liners, whose closures had been effected with the use of this Glu-Weld adhesive were in perfect condition."

Packers for Leaky Tubing

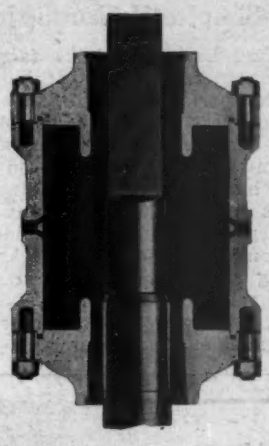
The packer for correcting trouble due to leaks in tubing discussed in The Oil and Gas Journal, January 20, 1944, page 54, was designed by J. O. Couch, superintendent, Lynde, Walter & Darby, water-flood operators, with the assistance of William H. Dyer, shop foreman, Western Drilling Tool & Supply Co., Chanute, Kans., the firm which manufactures and sells these packers for Couch and Dyer who own all rights for this equipment.

This packer is put on new pipe of either ¾-in. or of 1-in. diameter which is run inside the leaking tubing. Setting of the packer is done by an eccentric grip which expands the rubber of the packing; this expansion is accomplished by screwing down after the packer is in place. During the operation of setting, springs hold the rubber. This type of packer requires no anchor and no holddown.

Positive Blowout Preventer

An ingenious method of preventing blowouts while carrying on drilling operations has been developed by Regan Forge & Engineering Co., San Pedro, Calif. The device consists of a steel housing in which is placed a cylindrical rubber which can be contracted to effect a tight squeeze around any object within the blowout preventer.

The rubber packer has molded into its inner and outer peripheries a series



of longitudinal indentations which form a bellows. When pressure is applied behind the rubber cylinder the rubber contracts inwardly, accordion-like, and forms an impervious seal around the center object such as a kelly, drilling tool, tubing or drill pipe. The more pressure applied, the more positive becomes the seal. If only a slight pressure is applied it can be used as a stripper.

The device is tested to 3,000 and 6,000-lb. pressures, and is made in sizes from 6⅝ in. to 18⅝ in.

British Manufacturers Organize Trade Council

LONDON. — The Council of British Manufacturers of Petroleum Equipment was formed here recently with three main objectives. The council will seek active collaboration with government departments having in view the representation of the interests of the petroleum industry in the United Kingdom and northern Ireland and to promote greater attention by British engineering firms to the requirements of the oil companies for equipment at home and abroad. Third objective is to acquire and disseminate among the firms interested up-

to-date information regarding such equipment, and in all these ways to help the national effort in combating unemployment in the postwar period.

The first annual general meeting was held on July 27 when the new executive committee of 12 members was elected. The following are officers of the council: S. T. Robson, Esq., representing Head, Wrightson & Co., Ltd., chairman; N. Matheson, Esq., representing Le Grand, Sutcliff & Gell, Ltd., vice chairman; C. R. Sams, Esq., representing George Kent, Ltd., treasurer, and T. L. Bonstow, Esq., secretary.

Address of the secretary is 47, Parliament Street, Westminster, London, S.W. 1.

New Simplex Hydraulic Jacks

Moving heavier weights faster is the urgent requirement of industry and transportation in the war effort, and to meet the need, Templeton, Kenly & Co., Chicago, has added tandem-pump, Simplex 30-ton and 50-ton hydraulic jacks to its line. Up to this time, a 20-ton capacity was the largest hydraulic jack made by this company. These new jacks are playing an important part in shipyards, railroad yards and industrial plants, especially where cranes are not available.

These powerful hydraulics have high and low-speed pumps. The pumps can be operated singly or in

unison. They are sturdy, dependable and easy to operate.

The base is made of special analysis solid steel bar stock which adds to the load-bearing security. The jacks have two release valves located on opposite sides of the base for the convenience of the operator. Either release screw controls ram return. The easy-carrying grip is an integral part of the high-speed pump. They can also be carried by two men by simply inserting the jack lever through both pump handle sockets.

Ryerson Buys Bethlehem Pittsburgh Warehouse

On February 1 Joseph T. Ryerson & Son, Inc., purchased from Bethlehem Steel Co. its Pittsburgh steel-warehouse plant. The property consists of a large modern warehouse building, containing 150,000 sq. ft. on an industrial site of several acres. The building is equipped with cranes and will readily lend itself to future improvement and expansion.

It is located in Carnegie, Pa., adjacent to Pittsburgh, and well situated for distribution in the Pittsburgh industrial area, as well as for trucking and freight service throughout the territory normally served by Pittsburgh distributors.

Due to limited office facilities at the plant, Ryerson has opened a sales office in the Grant Building, 330 Grant Street, Pittsburgh.

Included in the purchase is the

Why JENSEN Units are so Practical

Sometimes men who never saw an oil well think they know more about pumping than producers know.

JENSEN Jacks are not designed by such theorists. Our units have grown out of 25 years of field experience.

History backs our contention that any well is likely to be more profitable when JENSEN equipped.

See our pages in your Composite Catalog or write for Bulletin No. 27.

JENSEN

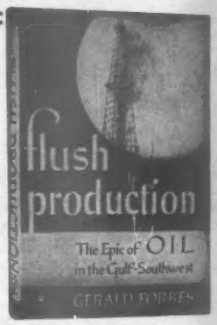
BROTHERS MFG. CO.

Coffeyville, Kansas, U. S. A.

Export Office: 50 CHURCH STREET, NEW YORK CITY

. . . . The Epic of Oil in the Gulf-Southwest

by GERALD FORBES



flush production

A vigorous, readable history of oil in Oklahoma, Kansas, Texas, Louisiana, Arkansas, and New Mexico, where more oil has been produced than in the whole world outside of the United States $2.75

"It's recommended reading."—Claude V. Barrow, Oil Editor of *The Daily Oklahoman*.

"Forbes is eminently qualified to write a readable and authoritative history of the oil industry."—*The San Antonio Evening News*.

Send your order and payment to

BOOK DEPARTMENT

The Oil and Gas Journal, Tulsa, Oklahoma

Bethlehem stock of bars, shapes, plates and sheets. It is the Ryerson plan to augment this stock and plant facilities as soon as conditions permit, making available a full line of steel products as provided by the other 10 Ryerson plants.

Howard L. Robinson of the Ryerson Cleveland organization, who has served in the Pittsburgh territory for some time, will be located in the Grant Building as the Ryerson Pittsburgh representative. W. W. Kopf of the Ryerson Philadelphia plant, will be located at the plant office in Carnegie. Both men have had many years of experience, and should prove of definite assistance to the manufacturers in this area.

New Crown Block For Portable Rigs

A new crown block incorporating important advantages in portable-rig operations has recently been developed by Baash-Ross Tool Co., 5512 Boyle Avenue, Los Angeles 11, Calif. The block is more compact, and is so designed that simple over-and-over reaving of the drilling line is made possible. This feature eliminates crossover of the lines and insures the traveling block rising and falling vertically without drift or "fleet angle," an important advantage in the cramped quarters of portable masts.

Figure 1. ABOVE BLOCK WITH COVER REMOVED SHOWING OFFSET ARRANGEMENT OF SHEAVE FOR OUTSIDE FAST LINE.

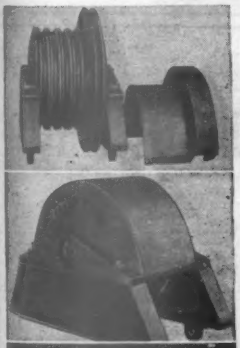


Figure 2. STRAIGHT-IN-LINE BLOCK FOR RIGS WITH FAST LINE INSIDE.

Figure 3. SHOWING ARRANGEMENT OF BAASH-ROSS TYPE DCO. CROWN BLOCK.

A valuable construction feature of the new block is that all sheaves are mounted in line, so that all lines are parallel and in the same plane as they feed to and from the block. This not only prevents traveling-block drift, but also eliminates pull-back from the center of the hole and reduces the risk of striking the inside bracing of the rig or the finger board. Pipe handling is made easier, since the derrick man does not have to contend with a twisting block when catching pipe, and the floor men do not have to work against the pipe swinging off center.

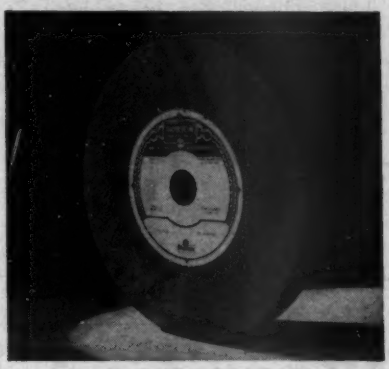
The new crown block is made in two styles, Type DCO and Type DCS. Type DCS is designed for use where the fast line comes down the inside of the derrick, while Type DCO is made for rigs where the fast line comes down to the draw works on the outside of the rig.

Perrault Brothers Enlarge Facilities

The office and warehouse of Perrault Brothers are now established at 1130 North Boston Avenue, Tulsa, where provision has been made for handling pipe-line, oil-field and industrial equipment business. The firm is a partnership of Lewis Perrault and Ainslie Perrault. Bo Bardsley is manager of the pipe-line supply department. The organization is engaged in the manufacture of coating and wrapping machines; it is an agent for Stearns Electronic holiday detectors; and it handles a complete line of pipe-line supplies.

Norton Co. 57 Alundum Abrasive Now Available For General Use

Norton Co., Worcester, Mass., announces that grinding wheels made of their 57 Alundum abrasive are



now available for general use, 57 Alundum abrasive is an improved aluminum oxide product which was developed by the Norton research laboratories several years ago and which proved an immediate success in wheels for cylindrical grinding, centerless grinding, internal grinding and snagging (slow speed).

57 Alundum abrasive is more friable than regular Alundum abrasive. This means that wheels of 57 Alundum have a fast, cool cutting action as they tend to keep themselves sharp but they also have the ability to hold shape and require few dressings. They have been especially successful in crankshaft grinding where the ability of the wheel corner to stand up is very important.

Among Equipment Men

Walton Heads Tulsa Nomads

J. W. WALTON

George W. (Jack) Walton, of Clark Brothers, Inc., was elected president of the Tulsa Nomads at the annual meeting of the club held February 14 at the Tulsa Club. Other officers are: Shep Miers, Southwest Supply Co., vice president; H. M. Cosgrove, Purchasing Agents Association, secretary-treasurer; A. G. Bailey, Fred E. Cooper Co., sergeant at arms; P. E. Fitzgerald, Dowell Inc., and C. O. Willson, The Oil and Gas Journal, regents.

H. M. Cosgrove, who served as vice president in 1943 and who previously was secretary-treasurer of the club for 3 years, was presented a wrist watch and bond by the membership as "an expression of the esteem with which he is held by the Tulsa Nomads." P. E. Fitzgerald, retiring president, was presented with a pen and pencil set by the membership. D. R. Davis of U. S. Rubber Co., and who formerly engaged in petroleum exploration work, spoke on "Egypt" at the annual dinner.

Link-Belt Elects Vice Presidents

W. C. Carter, president of Link-Belt Co., Chicago, announces the election by the board of directors of two vice presidents, effective January 1.

E. L. Berry, vice president and general manager of Link-Belt Ordnance

Co., has been elected vice president of the parent organization. He began his Link-Belt career in 1914, and has for many years devoted his time particularly to matters of production and personnel. His new headquarters will be at the company's general office, 307 N. Michigan Ave., Chicago.

Richard F. Bergmann, company chief engineer, has been elected a vice president of Link-Belt Co., with headquarters at the company's general office, Chicago, as heretofore. He came to Link-Belt in 1924, through the purchase of Howe Chain Co., Muskegon, Mich.

John E. Martin has been appointed manager of Link-Belt Ordnance Co., with headquarters at the plant. He started his Link-Belt career in 1927, and since Pearl Harbor has been assistant to Brig. Gen. G. M. Wells, War Department, Washington, D. C.

Los Angeles Nomads Elect Officers

ROLAND E. SMITH

The election of officers and regents for the coming year was held recently at the annual meeting of the Los Angeles Chapter of Nomads. The following men were elected: Roland E. Smith, president; Wallace A. Sawdon, vice president; J. C. Ballagh, secretary; Elmer R. Smith, treasurer; William McGraw, sergeant at arms; John Dodge, assistant secretary; Fred Tyler, assistant treasurer; T. M. Johnston, deputy sergeant at arms; W. F. Bettis and Henry W. Pullman, regents.

The fifth annual inaugural ball in honor of the incoming and outgoing officers was held in the Rendevous Room of the Biltmore Hotel of Los Angeles on February 5.

Following the annual business meeting the Nomads and their guests assembled for the regular dinner meeting.

Edwards Appoints Hunt Tool Gulf Coast Distributor

E. H. Edwards Co. has appointed Hunt Tool Co. exclusive oil-field distributor in the Gulf Coast area for Edwards wire rope, stocks to be available from Hunt's Houston, Bay City, Corpus Christi, Jennings and Harvey shops.

Classified Advertising

The Market Place for the Oil Industry

UNDISPLAYED RATE

8 CENTS A WORD, minimum charge $2 per insertion.

SITUATIONS WANTED, 4 cents a word, minimum charge $1.

BOX NUMBERS, count 9 words when replies are to be sent to our Tulsa Office.

10% DISCOUNT if 3 insertions are ordered at one time, with check accompanying order.

All classified advertising payable in advance.

DISPLAYED—PER INCH

Classified display advertising set in single or double column style:

1 inch	1 time	$7.00
1 inch	13 times	6.50
1 inch	26 times	6.00
1 inch	39 times	5.50
1 inch	52 times	5.00

Rates are governed by total space used within 12 months from date of first insertion. Credits are allowed when lower rates are earned.

FORMS CLOSE 9:00 A.M. MONDAY
Published Each Thursday

EXPLORATION

GRAVITY Meter Party available about April 15, 1944. Seismograph Party about July 15, 1944. Box C-178, The Oil and Gas Journal, Tulsa, Okla.

LEASES AND DRILLING BLOCKS

DEEP drilling, new fields, 2,094 wells producing. Montana oil fields face action, 1944! Keep in touch! Free trial subscription! Montana Oil Journal, Elks building, Great Falls, Mont.

NOTICE of Oil and Gas Lease Sale. Southern Ute Indians will lease by bid approximately 1,280 acres. Bids to be opened March 15, 1944. Information may be secured from Floyd E. MacSpadden, Superintendent Consolidated Ute Indian Agency, Ignacio, Colo.

LEASES AND DRILLING BLOCK

NEW MEXICO
STATE OIL AND GAS LEASES

Humble Oil & Refining Co., now drilling a scheduled 7,500 foot test. Other major oil companies own lease blocks near test. I offer 40 acres and multiples thereof in same area. Write for information. HARRY S. WRIGHT, New Mexico State Lessee, Farmington, New Mexico.

ARKANSAS-Louisiana-Texas leases twenty acres up. Dollar acre up. Owners Box 1122, Little Rock, Arkansas.

LEASES AND DRILLING BLOCKS

FOR SALE: New 80 acre, 10 year semi-proven lease, E. Texas, $3.25 per acre. Write C. A. Parker, Box 451, Center, Texas, for details.

WYOMING AND MONTANA, the next big oil fields. Have blocks on big structures, will drill. You can get in ground floor today. Wire or write. P.O. Box 272, Denver, Colo.

LEASES ROYALTIES

PRODUCING OR NONPRODUCING
Texas, New Mexico, Oklahoma
Louisiana and Illinois.
20 Years' Experience
Inquiries Invited.

B. D. BUCKLEY
60 Broadway Drive, Clayton
St. Louis, Mo.

A WORTHWHILE OPPORTUNITY

We own properties in California, Illinois, Indiana, Kansas, Louisiana, Nebraska, Oklahoma, Texas.

All of our properties have been broadly classified for oil possibilities by DeGolyer and MacNaughton of Dallas, Texas. This outstanding firm of geologists have selected from our total holdings certain properties, comprising more than 50,000 acres, as immediately suitable for oil and gas prospecting.

We invite inquiry from responsible drillers. We also have considerable acreage which we will consider leasing. Address P. O. Box 177, Cincinnati, Ohio.

Classified Advertising

EQUIPMENT WANTED

WANTED: Combination Dubbs Topping Plant operators; Combination power plant boiler operators; Pumpers; Still helpers, combination topping and cracking; Refinery Pump Mechanic, and refinery machinist. Location, inland Texas independent refinery. Box C-155, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Drilling Machine Without Tools. Consider late Model K. Star; #43 Star Spudder; #24L Bucyrus or Super H Fort Worth Spudder. A. V. Smith, Jr., 1921 Frederica St., Owensboro, Kentucky. Phone 1851.

WANTED: One or two Butane tanks of about 1,500 gals., new or used, for drilling rigs. Address M. L. Massingill, 433 Devine Road, San Antonio 1, Texas.

WANTED

Unlimited quantity of
Structural Steel — Pipe — Tubing
Casings and Valves, all sizes

SONKEN-GALAMBA CORP.
Kansas City (15), Kansas

RANCHES AND FARM LANDS

10,000 acre ranch Cimmaron County, Okla. Near Pure discovery well on one side and Hugoton field on other, not leased. Excellent ranch, large potential value. John P. Mathis, Box 1106, Amarillo, Texas.

PATENT ATTORNEYS

PATENTS, Trade-Marks, Booklet, "General Information Concerning Inventions and Patents" and "Free Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 418, Bowen Bldg., Washington, D. C.

OIL REPORTS

OIL REPORTS
SOUTH GEORGIA
6 month sub. $6.00
C. W. Deming—Publisher
Waycross, Georgia
20 years operating out of Tulsa.

BUSINESS OPPORTUNITIES

FOR SALE: Independent oil well cementing company doing good business. Two practically new 5-ton trucks and one late model field car, fully equipped, with very low mileage and new rubber—to do any kind of job for oil well cementing service. Reason for selling, account of bad health. Box C-177, The Oil and Gas Journal, Tulsa, Okla.

FINANCING

CAPITAL SEEKERS — Interested in raising $25,000 or more for a legitimate project should write to AMSTER LEONARD, Fox Theater Bldg., Detroit 1, Mich.

CAPITAL inexpensively raised. Write for our proposition today. No charge for consultation. Address: Service P.O. Box 188, Chicago 90, Ill.

FOR SALE—MAPS

GEORGIA AND FLORIDA MAPS
Base map north Florida. Base map south Georgia. County maps north Florida and south Georgia. McIntosh Bros., Waycross, Ga.

FOR SALE—MAPS

855 oil fields in South Texas and Louisiana now mapped and maintained daily; show all intimate details of ownership and development. 2 ft. square. Price $3.50 for each field. Also County and Base Maps.

ZINGERY MAP CO. Houston, Tex.

HELP WANTED

WANTED, by a leading steel manufacturer; experienced field engineer for oil country tubular goods work; also want experienced man for sales and sales engineering work on seamless and welded mechanical and pressure tubing; Attractive opportunities. Write in full to Box C-160, The Oil and Gas Journal, Tulsa, Okla.

PRODUCTION AND DRILLING ENGINEER with practical experience in all phases drilling and production capable assuming full responsibility and supervision of operations well established independent company. Good salary. Box C-161, The Oil and Gas Journal, Tulsa, Okla.

PIPE-LINE PUMP STATION ENGINEERS Familiar with diesel type engines, for work in Oklahoma. 48-hour week. Major oil pipeline company. State qualifications, draft status, age, and salary desired. Box C-123, The Oil and Gas Journal, Tulsa, Okla.

OIL REFINERY
INSTRUMENT ENGINEER

Who is thoroughly experienced on selecting and specifying instruments.

FURNACE DESIGNER

experienced on oil refinery work.

5½-day week with time and one-half for work in excess of 40 hours per week. Apply at once, giving complete details including hourly rate desired. Statement of Availability required.

ARTHUR G. McKEE & COMPANY
2300 Chester Avenue
Cleveland, Ohio

CHEMICAL ENGINEERS with experience in any of the following petroleum refining operations (1) light ends recovery equipment, absorbers, stabilizers, etc. (2) catalytic cracking equipment or (3) crude distillation equipment and similar processing units. State in detail educational background, positions held with detailed explanation of work handled, age, and number dependents also draft status. Box C-165, The Oil and Gas Journal, Tulsa, Okla.

Wanted by Major Pipe Line Company
CIVIL ENGINEER, an excellent opening for an engineer capable of doing part-time drafting in headquarters office and survey work in the field. MECHANICAL ENGINEER, a permanent position as supervisor of mechanical maintenance and installation. Pipe-line experience required. Headquarters Tulsa. State qualification, draft status, age, and salary desired. Box C-122, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Chemist familiar with manufacture of White Oils and Sulphonates. Give age, experience, references, salary expected, draft status and when available. Box C-153, The Oil and Gas Journal, Tulsa, Okla.

REFINERY CHEMISTS

Refinery analytical chemists and low and high temperature fractional operators wanted for work in 100-octane plant. Write Personnel Manager, Associated Refineries, Inc., Duncan, Okla. W.M.C. Certificate necessary.

PROCESS ENGINEER

Two Process Engineers, also two Junior Process Engineers. Must have chemical, mechanical or petroleum engineering degree. W.M.C. Certificate necessary. Write Associated Refineries, Inc., Box 831, Duncan, Oklahoma.

SITUATIONS WANTED

GEOLOGIST, 18 years experience drilling wildcats and field wells in southwest Texas; now chief Geologist, Independent Oil Company; would consider similar position with operator who would allow personal Royalty and Lease trades. Draft Classification 2-AH. Box B-975, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

OVER 20 years general refinery sales, traffic, oil marketing, experience, now employed, desires immediate change. Age 42, married, good salary required. Best references as to ability, etc. Box C-162, The Oil and Gas Journal, Tulsa, Okla.

CORPORATION LAWYER, middle age, 20 years experience in Legal Departments of major and independent companies. Thoroughly familiar with oil and gas law and titles in the Mid-Continent States. Now employed eight years in Legal Department of major company. Desires change solely for personal reasons. Over draft age, in good health, married, one child. Available after reasonable notice. Would require salary around $6,000. Box C-168, The Oil and Gas Journal, Tulsa, Okla.

GRADUATE Geologist, recently graduated from Lafayette College, Easton, Pa., no field experience, but willing to work hard and go anywhere in continental N. A. In perfect health, age 26, and draft deferred. Can furnish a certificate of availability and excellent references. Richard W. Harding, River Road, Yardley, Pa.

FOR oil drilling locating we use the Multiple Gravitation Insulation Geology Block System. A positive method. We can locate oil pools from airplane. Draper & Co., Seymour, Iowa, Route 1.

GEOLOGIST, with experience in reconnaissance, mapping, leasing, scouting, subsurface study, desires employment with strong oil company. Not interested in duration job. Draft exempt. Box C-171, The Oil and Gas Journal, Tulsa, Okla.

TAX expert desires change. College education, age 39, certificate available. 18 years experience, 10 years with present employer, major oil company. Would leave Tulsa. Box C-173, The Oil and Gas Journal, Tulsa, Okla.

YOUNG MAN, 35, married, 2 children, University trained, over fifteen years experience in natural gasoline and recycling plant operations, desires situation with progressive organization. Has had broad experience in laboratory, close fractionation, plant operation, plant control, process design, construction, and organization work. Has working command of Spanish, both written and spoken. At present is superintendent in charge of one of the larger plants in the southwest. Certificate of availability can be obtained upon reasonable notice to present employers. Box C-175, The Oil and Gas Journal, Tulsa, Okla.

NEED new blood in your refinery? Have 18 years experience in general refinery work, primarily cracking. Last seven years in supervisory position. Now employed. Would like to contact growing independent with good postwar opportunities. Box C-174, The Oil and Gas Journal, Tulsa, Okla.

ROYALTIES

OIL AND GAS ROYALTIES for sale in Western Kentucky Coal Basin. Now leased to large producing company. For prices and particulars, write Box C-167, The Oil and Gas Journal, Tulsa, Okla.

Undivided 1/6th mineral int. under 687,685 acres located in Sections 4, 35, 7, 9, 31, 15 and 25, Blk. 2; and Sections 1, 17 and 19, Block 3, H.&T.C. Ry. Co. Survey, Pecos County, Texas. C-172, The Oil and Gas Journal, Tulsa, Okla.

WANTED

WANTED

GAS RECYCLING PROJECT

By large independent having available new, complete compression equipment capable of handling large volume and high pressures. Interested in high pressure wet gas area, good gasoline content, good reserves, sufficient wells already drilled for a recycling operation. Prefer project with gasoline extraction plant already operating but with limited market for residue dry gas. Give all information possible first letter. P.O. Box 1914, Fort Worth, Texas.

ADVERTISERS IN THIS ISSUE

Ajax Iron Works 33
Allis Company, Louis 35, 36
Aluminum Co. of America 94
American Rolling Mill Co., The 68
Armstrong Machine Works 114
Associated Piping & Engineering Co., Inc. 101
Baker Oil Tools, Inc 54
Baroid Sales Division, National Lead Company 7
Beeson Bros. Engineering Co. 51
Blackstone Hotel, The 147
Braden Steel Corporation 120
Briggs & Stratton Corp. 102
Broderick & Bascom Rope Co., Front Cover
Cameron Iron Works, Inc. ..... Inside Back Cover
Cardwell Mfg. Co., Inc. 2
Carey Mfg. Co., The Philip 14
Caterpillar Tractor Co. 17
Century Electric Company 24
Classified Advertising 154, 155, 156, 157
Cleveland Trencher Company 131
Climax Molybdenum Company 150
Columbian Steel Tank Co. 138
Cooper, Fred E. 21
Crutcher-Rolfs-Cummings 121
Darling Valve & Mfg. Co. 130
Davis Regulator Co., The 114
Dean Brothers Pumps, Inc. 141
Diamond Chain & Mfg. Co. 126
Dowell, Incorporated 52
Dravo Corporation 118
Dresser Mfg. Co., The 8
Eagle-Picher Lead Co., The 136
Emsco Derrick & Equipment Co. 15
Engineers & Fabricators, Inc. 141
Ensign Carburetor Company, Ltd. 108
Farell-Birmingham Co., Inc. 12
First National Bank & Trust Co. of Tulsa, The 139
General American Transportation Corp., Plate & Welding Div. 5
General Paint Corporation 140
Girdler Corporation, The 79
Goodrich Company, The B. F. 3
Gott Mfg. Co., H. P. 114
Grancell, I. H. 144
Graver Tank & Mfg. Co., Inc. 29
Grinnell Company, Inc. 86
Guiberson Corporation 51
Hanlon-Waters, Inc. 123
Hill-Hubbell & Co. 140
Houston Ready Cut House Co. 103
Hughes Tool Co. ..... Back Cover
Hunt Tool Company 28
Hycar Chemical Co. 112
International Harvester Co. 80
Jeffrey Mfg. Co., The 144
Jenson Bros. Mfg. Co. 152
Jones Co., The S. M. 104
Justrite Manufacturing Co. 118
Kennedy Valve Mfg. Co., The 20
Keuffel & Esser Co. 51
Kidde & Co., Inc., The Walter 116
Ladish Drop Forge Co. 39
Landis Machine Company, Inc. 11
Lane-Wells Company 27
Laughlin Co., The Thomas 132
Levingston Shipbuilding Co. 133
Leyman Mfg. Corp. 20
Lincoln Electric Company, The 76, 77
Link-Belt Company 26
Little, I. C. 122
Lucey Export Corporation 25
Lufkin Foundry & Machine Co. 88, 89
Lufkin Rule Co. 46
Lummus Co., The 9, 10
MacClatchie Mfg. Co. 145
McCord Radiator & Mfg. Co. 121
Marley Company, The 4
Marsh Corp., James P. 47
Merco Nordstrom Valve Co. ..... Inside Front Cover
Mission Mfg. Co., The 85
Murphy Diesel Co. 135
National Airoil Burner Co., Inc. 100
Neptune Meter Co. 45
New Mexico Construction Co., Inc. 145
Norris Brothers, Inc. 141
Norton Company 40
Norvell-Wilder Supply Co. 30
Oakite Products, Inc. 29
Oil Well Improvements Co. 147
Pacific Pump Works 31
Pacific Wire Rope Co. 30
Page Steel & Wire Division of American Chain & Cable Co. 32
Patterson-Ballagh Corporation 148
Penberthy Injector Co. 97
Perco Division of Phillips Petroleum Co. 91
Petroleum Electric Power Association 119
Petroleum Engineering, Inc. 106, 107
Petroleum Rectifying Company 42
Pierce Governor Co., Inc. 34
Preformed Wire Rope Co. 10
Price Co., H. C. 121
Rector Well Equipment Co., Inc. 139
Republic National Bank of Dallas 96
Republic Steel Corporation 40, 41
Richmond Chemical Co., The 137
Seismograph Service Corp. 123
Sisk Co., The 143
Smith Oil Tool Co., H. C. 18
Soph Co., The Edward 117
Standard Steel Corp. 37
Taylor Instrument Companies 38
Texas Electric Steel Casting Co. 6
Texas Pipe Bending Co. 117
Thomas Flexible Coupling Co. 134
Thornhill-Craver Co. 145
Timken Roller Bearing Company 33
Timken Roller Bearing Company, Steel & Tube Division 43
Trefolite Company 30
Twin Disc Clutch Co. 22
Union Iron Works 46
United Contracting Co. 131
United Gas Pipe Line Co. 38
Universal Oil Products Co. 71
Victaulic Company of America 13
Vogt Machine Co., Henry 44
Wagner Electric Corporation 19
Walworth Co. 1
Wilson Manufacturing Co., Inc. 72
Wisconsin Motor Corporation 142
Worthington Pump & Machinery Corporation 41

Journalisms:

THE daddy of all petroleum-butadiene plants was unveiled this week at Port Neches, Tex., and soon will take its position as a completed unit in the nation's synthetic-rubber program. The Neches Butane Products Co. plant cost is estimated at $60,000,000, nearly double the cost of the next largest similar plant in the industry. Facilities are expected to produce a minimum of 100,000 short tons of butadiene annually but it would not be surprising either to the design engineers or the operating company if this figure is substantially exceeded. This background lays the predicate for next week's editorial program of the Journal. Four to five pages of the Engineering and Operating Section will be devoted to illustrations and description of the technical aspects of the Neches plant and summary coverage of the dedication ceremony which took place earlier this week will be published in the News Section. The equipment requirements in the Neches plant are enormous, virtually defying description.

CALENDAR

February

AMERICAN SOCIETY FOR TESTING MATERIALS, spring meeting and committee week, Netherland Plaza Hotel, Cincinnati, Ohio, February 28 to March 3.

March

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS, SOCIETY OF EXPLORATION GEOPHYSICISTS, AND SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS, annual meetings, Dallas, Tex., March 21-23.

WESTERN PETROLEUM REFINERS ASSOCIATION, thirty-second annual meeting, Jefferson Hotel, St. Louis, Mo., March 28.

AMERICAN GAS ASSOCIATION WAR CONFERENCE ON INDUSTRIAL AND COMMERCIAL GAS, Hotel Seneca, Rochester, N. Y., March 30-31.

April

INTERSTATE OIL COMPACT COMMISSION, spring quarterly meeting, Roosevelt Hotel, New Orleans, La., April 3 and 4.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, annual meeting, Rice Hotel, Houston, Tex., April 10, 11 and 12.

NATURAL GASOLINE ASSOCIATION OF AMERICA, annual meeting, Baker Hotel, Dallas, Tex., April 12-14.